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CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

Recession Continues: Outlook Improves

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It is important to make the distinction between conditions as they are and the outlook for the future. Industry and business are declining, and a condition of depression exists. However, the first signs of a possible future turn have appeared. The position here taken, therefore, is that the bottom of the existing severe recession in business will be reached late in the summer and that conditions will be ready to improve some time in the fall, although possibly not until October.

This forecast is highly tentative, as it must be admitted that an unusual degree of uncertainty attends the present situation. It is possible that the recovery here anticipated will be very short-lived, and that data for another month may reverse the outlook for the future.

Recent Developments

1. Downturn in retail trade (Fig. 8).
2. Abnormally unfavorable weather affecting business and crops.
3. Money rates down to depression levels (Fig. 9).
4. Automobile and building activities decline (Fig. 6).
5. Employment of labor declines (Fig. 12).
6. Production in basic industries declines (Fig. 2).
7. Marked gain in business failures (Fig. 10).
8. Increasing evidence of wages being out of line.
9. Grain prices turn sharply upward.

Though not numerous, the favorable factors affecting the industrial *forecast* gained in weight.

Favorable Factors

1. Continued rapid checking of overproduction.
2. Greater stabilization in prices (Fig. 9).
3. P/V line ceases to decline (Fig. 1).
4. Increase in stocks of commodities checked (Table 1).
5. Exports hold up well.
6. Pig iron buying revives somewhat.
7. Money at bottom levels.

Unfavorable Factors

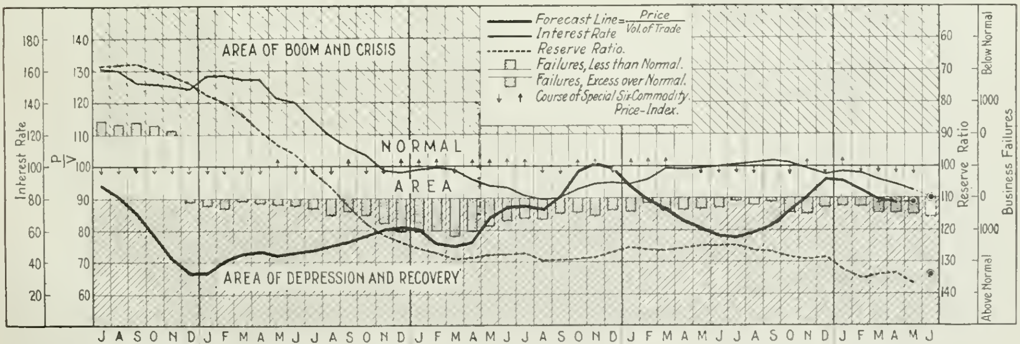
1. Building activity declines (Fig. 6).
2. Automobile output declines.
3. Sharp decline in unfilled steel orders (Fig. 3).
4. Decreased employment and earnings (Fig. 12).
5. Decreased bank debits (Fig. 7).
6. Increased business failures (Fig. 10).
7. Declining prices (Fig. 9).

Future Dangers

At the present writing the future dangers affecting the industrial outlook are as follows:

1. *Reduced purchasing power.*
2. Strained credit due to sales "on time".
3. Increasing competition from Europe.
4. Wages too high.
5. Strikes and labor difficulties.
6. Possibility of third party developments leading to uneconomic class legislation, unbalanced budgets, etc.
7. Withdrawal of European capital.
8. Inflation.

The reader should carefully weigh the following analysis. To begin with, the main forecasting line, the P/V line in



Data on the compilation of this curve can be obtained upon request to the editors.

Fig. 1 The Barometer of Industry and Trade

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[1] Assisted by Horace J. Barney and R. H. Leding of the Bureau's staff.

Fig. 1, has definitely turned upward although the upturn is slight. The close conformation of this line to actual developments of which it gave advance indications, creates a strong presumption that within five months business will have begun to move up. It means that the end of the general decline in prices is approaching, that the decline in production will begin to taper off, and that within a few months the outlook for profits in business will improve. But for political uncertainties, the turn should come about October.

Setback Just Being Felt

The extent of the existing setback in business is only beginning to be realized by many. Business in most lines is decidedly bad and a real and unusually sharp downward swing in the cycle is going on. Practically all reliable indexes point downward. Overproduction in many important industries exists, and heavy stocks of basic commodities burden the markets. Prices in general are declining.

The lateness of the spring and the abnormal weather conditions which have existed are a major factor in the situation. Not only have important crops been injured, or made subject to injury through delayed planting, but the market for seasonal goods has been severely curtailed. Hardware, clothing, gasoline, and sugar, are only a few of the important products, the consumption of which has been restricted by bad weather. A careful appraisal of this factor indicates that it has no small importance in determining the industrial situation for 1924.

Partly on account of overproduction and partly on account of weather conditions, the automobile and building industries have been on the decline for a month or two and this has resulted in a reduction of the demand for metals, textiles, and building materials in general.

As forecast in these pages, retail sales have now turned downward. The decline as yet is small, but seems likely to go further. Mail order sales of the two great Chicago houses in May fell off 4.7 per cent, after eliminating the usual seasonal change, and chain store sales also registered a small decrease in comparison with normal seasonal variation.

There has been much loose talk concerning the smallness of "inventories". As has been pointed out here, however, *the stocks of basic commodities in first hands have been unduly large.* Certainly stocks of iron and steel, copper, oil, leather, paper, and automobiles, do not indicate the existence of small inventories.

The trend of employment is also not encouraging, since it not only indicates recession in production, but tends to reduce earnings on the part of laborers of all kinds, which in turn means diminished purchasing power. New York factory employment decreased 3.5 per cent in May after allowing for seasonal change.

The more intangible factors, such as domestic politics and European conditions, do not seem to give any ground for optimism. The third party threat still exists. Developments in German and French politics are hardly encouraging, since increased willingness on the part of France to make concessions seems only to increase the probability of German resistance.

In listing the unfavorable conditions, the fact that labor has not deflated along with business, is to be noted. This undoubtedly has an important bearing on foreign trade as well as on the outlook for manufacturing profits in general. With wages at peak levels, while prices have been much reduced and foreign competition has been increased, a serious problem exists.

In this connection evidence of increasing competition from abroad may be noted. Reports have it that even such heavy products as building materials are being imported into the country to an increasing extent.

Signs of Improvement

But not infrequently it is just when everything looks the darkest that the bottom is near. (It will be remembered that about January most signs looked favorable, but that the downturn came almost immediately). The fundamental fact about the situation is that there has been a remarkably speedy curtailment in production and that great progress has been made in bringing the rate of production down to a level where stocks will cease to pile up and consumption will take care of output at firm prices. The most valuable current index of industrial movement is that furnished by railway tonnage. This index has now declined sharply for two months. In May it fell off about 4.8 per cent after eliminating seasonal variation, and was only 17 per cent greater than the average for 1921. When it is remembered that 1921 was a year of great depression, and further that some allowance must be made for normal growth, it seems fair to say that the tonnage of commodities is already somewhat less than normal.

Signs of increased purchasing of pig iron, together with some irregular upturns in the price of scrap steel, appear to indicate that the bottom in that basic industry is not distant.

Although during May there was a decline in wholesale prices of over 2 per cent, it is probable that during June the price decline will be greatly moderated if it is not entirely checked. In the middle of June the downward trend of the six-commodity group appeared to have ceased. Textiles, cottonseed oil, and pig iron were, on the average, firm, while grains had shown sharp advances.

On the whole, the gain in grain prices is a favorable sign. While the indicated smaller crop is to be considered as an offset, yet so considerable a rise in price as has occurred in wheat is beneficial. The agricultural situation is still bad, and is only a little worse than it was a month ago.

The better outlook reflected in the stock market should be noted. The stock market is always to be regarded as a valuable barometer and the fact that the bulls have been able to bring about as sharp an upturn as occurred in the early part of June, is an indication that unfavorable factors have lost their predominance.

Probably the chief element in the stock market advance has been low money rates, and the same factor is important in business, although its effect here is slower. With call money at 2 per cent and best commercial paper at 3¾ per cent, funds are so "easy" that business will readily respond to any improvement in demand. The great question is, What will happen to the demand for commodities? The farm situation is not strong, and employment and earnings of labor are declining. *It is these things which cast doubt on the probability of the autumn recovery, which would otherwise be almost certain.*

Indications favor a further decline in business and industry, but one which will go on at a diminishing rate. Speculative markets will, as usual, discount the favorable indications. While the stock market will probably react from the high point reached about the middle of June, it appears that the worst has been discounted.

Year May Not Be Good

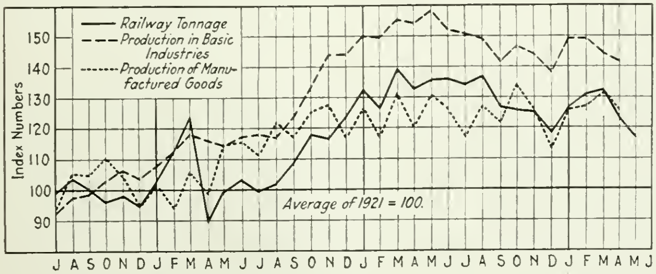
All this is not to say that 1924 will prove to be a good year. Undoubtedly earnings in that year in most industries will prove to be considerably lower than in 1923, but an upturn should occur toward the end of the year. We repeat from the last issue of Management and Administration: "With overcapacity and with increasing stocks of most basic commodities; with decreasing wholesale prices and employment of labor; the most that can be hoped for at present is a gradual stabilization of industry on a considerably lower level than obtained throughout most of 1923".

Production and Stocks of Commodities

Production Slows Up But Stocks are Still Large

As shown in Table 1, the stocks of many basic commodities are relatively high and the revised index of stocks of 45 commodities of the Department of Commerce is still at the highest level reached since October 1921.

Stocks of cattle, leather, zinc, newsprint paper, automobile tires, cottonseed oil, and merchant pig iron, all show increases; while gasoline and raw sugar stocks decreased, allowing for seasonal variation. Evidently the paper, rubber, and merchant pig iron industries are still in a weak position. In this connection the recent cut of $2 in newsprint paper may be noted. The gasoline situation seems stronger.



Sources, Federal Reserve Board; N. Y. U. Bureau of Business Research. Railway tonnage and production in basic industries corrected for seasonal variation, and the latter also for normal growth.

Fig. 2 Railway Tonnage and Production in Industry

Production and Railway Tonnage

Railway Tonnage. As shown in Fig. 2 the adjusted index of railway tonnage declined rather sharply in May. In that month Class 1 railways hauled approximately 103 million tons against about 101 million tons in April. This increase, however, is much less than usual for the month, with the result that the index declined from 122.7 to 116.8.

Production. In April production in basic industries continued to move downward, dropping from 144.3 in March to 141.8 (the average for 1921 being 100). Production in manufactures also declined for the first time this year, the index dropping from 131.6 to 125.4.

Conclusion. There has been a very prompt checking of the overproduction which developed early in the year. This decline began in April and is now in full swing. It is likely to go further. It promises, however, an early readjustment between demand and supply and is the only means of remedying the situation that is effective. Heavy stocks and overcapacity are the chief drawbacks to the situation, and will tend to delay the readjustment.

Iron and Steel Production

Production. The average daily production in pig iron in May showed a decrease of nearly 22 per cent from the April level. Forty-six additional furnaces went out of blast, and the index for May (see Fig. 3) stands at 181.8; only slightly above the point for October 1922.

Steel production showed a decline of 24 per cent in average daily rate, and the index for May was 157, the lowest since August 1922.

Unfilled orders. Unfilled orders of the United States Steel Corporation fell off 22 per cent during May, the June 1 figure being 3,268,000 tons, the lowest since November 1923. The most recent reports indicate that steel consumption continues to decline.

Unfilled orders for merchant pig iron furnaces showed a further decline of 25 per cent during April as predicted.

Prices. The Iron Age composite price for finished steel on June 17 was 2.603 cents per lb., a drop of 1.2 per cent from the price (2.639 cents) a month earlier. The composite pig iron price was $20.13 per gross ton as against $21.79 a month earlier, a drop of 7.5 per cent.

Conclusion. Although indications are that the severest decline in iron and steel production is past, price levels are still weak, and with the outlook what it is in the industries which are the chief sources of demand, there seems to be no hurry in buying. Some better inquiries have been reported in the case of pig iron, and it seems not unlikely that pig iron prices are near the bottom.

Production in Important Industries

As indicated in Fig. 4, the production in certain basic industries shows a mixed trend with sharp curtailment in textiles and increases in copper and paper.

Copper. Efforts to curtail the copper production have thus far failed and the increase in May production does not hold out hope of any early strength in copper prices.

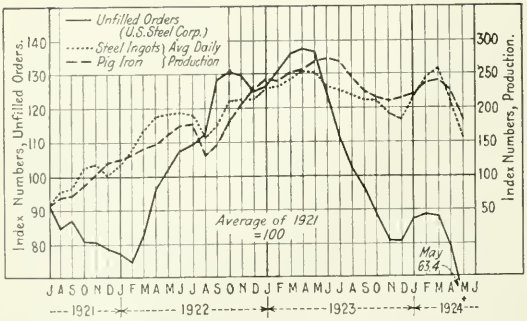
Paper. Paper production in April increased for the second successive month and was greater than in any month since May 1923. This, combined with the increase in newsprint stocks, has made weaker prices.

Wool. The index of wool consumption declined sharply in April. After eliminating seasonal variation, the index

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH

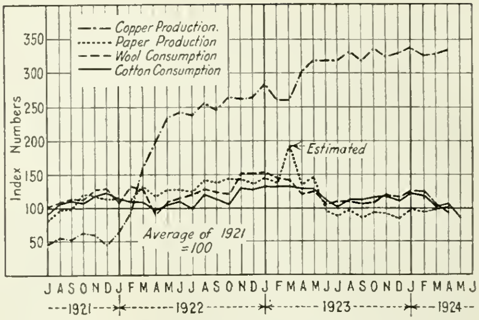
Average for 1921 = 100. Gasoline, raw sugar, cottonseed oil and Dept. of Commerce index adjusted for seasonal variation.

Month and Year	Gasoline	Leather (Cattle)	Zinc	Newsprint Paper	Automobile Tires	Raw Sugar	Cottonseed Oil	Merchant Pig Iron	Dept. of Com. Index of Stocks—45 Commodities
	100 = 630,757,000 gals.	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,009 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.	100 = 634,950 tons	100 = 132
Jan. 1923	156	85.3	23.6	64.0	105.4	55.0	52.0	35.8	87.7
Feb.	156	84.0	21.5	76.7	107.6	76.0	60.0	43.0	84.1
Mar.	154	82.6	14.1	77.3	119.7	86.0	64.5	44.0	84.8
Apr.	162	81.6	13.0	67.2	129.9	168.0	67.0	38.0	84.8
May	164	81.4	11.6	62.9	139.3	147.0	69.0	41.7	80.4
June	173	82.1	16.9	60.5	159.6	97.0	71.0	53.6	83.3
July	174	82.8	22.2	65.0	161.4	97.0	76.0	72.7	82.6
Aug.	185	83.6	27.5	74.0	148.0	96.2	74.0	97.5	90.6
Sept.	199	84.3	34.4	85.5	138.5	81.8	57.4	111.0	95.5
Oct.	206	84.2	29.6	82.2	123.2	130.4	28.0	121.7	85.5
Nov.	211	85.4	33.4	82.4	111.7	102.8	43.0	131.0	88.4
Dec.	202	85.8	40.3	80.0	107.5	89.8	43.3	141.0	90.6
Jan. 1924	186	87.0	47.3	78.8	99.0	79.0	52.5	145.0	98.6
Feb.	187.5	79.5	52.7	94.6	110.0	54.5	53.5	144.5	97.8
Mar.	188	83.8	48.0	101.0	120.0	90.0	58.5	140.0	98.6
Apr.	203	81.2	41.5	103.0	130.0	143.0	60.2	139.5	98.6
May	197	81.4	42.5	105.6	140.0	125.6	63.2	148.6	......
June	...	.....	54.9	....	..	...	.	.	....



Sources, Iron Age; American Iron and Steel Institute. All curves corrected for seasonal variation.

FIG. 3 IRON AND STEEL PRODUCTION AND UNFILLED ORDERS



Sources, American Bureau of Metal Statistics; American Paper and Pulp Association; Bureau of Census; Department of Commerce. Cotton and wool curves corrected for seasonal variation.

FIG. 4 PRODUCTION IN FOUR IMPORTANT INDUSTRIES

stood at 94.9 against 106.1 in March. This is the third successive decline of the adjusted index.

Cotton. There was an unusually sharp decline in the consumption of cotton in May which brought the adjusted index to the lowest level attained during the last three years. The number of bales consumed, 413,649, is the smallest since July 1921.

Conclusion. Such sharp curtailment in textiles is bound to bring firmer prices for cotton and woolen goods in the not distant future.

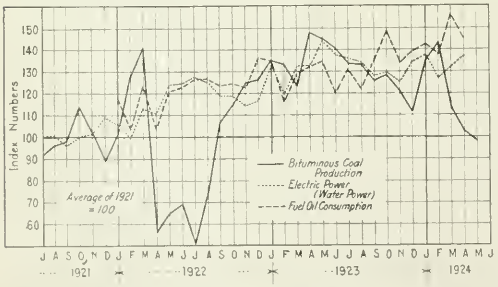
Fuel and Power

Coal. As shown in Fig. 5, bituminous coal is still on the down grade although the rate of decline is somewhat less. In May the production of bituminous coal was approximately 31,434,000 tons. This was larger than the quantity produced in April, but when allowance is made for the usual seasonal variation, the index declines. The adjusted index in May fell 3.9 per cent. The rate of production of bituminous coal is now below what it was on the average of 1921. While coal prices are at bottom levels, there is little likelihood of advance in prices as long as the business recession continues.

Fuel Oil. Fuel oil consumption also declined in April, which is the latest month for which data are available. The April consumption figure was down 7 per cent from March. Fuel oil consumption, however, is still running about 45 per cent over the monthly average of 1921.

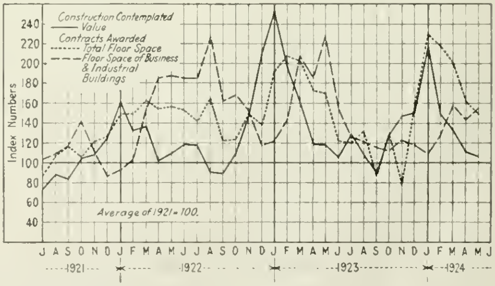
Hydroelectric Power. The April output of hydroelectric power increased. This is partly seasonal, however, and the abundant rainfall has caused hydroelectric power plants to make a large output.

Conclusion. The foregoing facts emphasize the depression in industry. In April the consumption of fuel oil and hydroelectric power was at a high rate, but at that time the recession in industry had not gone very far. The net result obtained from an examination of the data is the conclusion that, in so far as fuel and power are concerned, the figures do not reflect a decline in industry on so marked a scale as might have been expected.



Sources, Department of Interior; Bureau of Mines; United States Geological Survey. Bituminous coal and electric power curves corrected for seasonal variation.

FIG. 5 FUEL AND POWER PRODUCTION



Source, F. W. Dodge Company. Construction contemplated curve corrected for seasonal variation.

FIG. 6 BUILDING CONSTRUCTION AND FLOOR SPACE

Building Activity in May

Contemplated Construction. The F. W. Dodge Company's figures show further loss in the value of contemplated construction. (See Fig. 6). In May the actual value reported fell and the adjusted index declined 4 per cent.

Contracts Awarded. The floor space in total contracts awarded for building construction decreased 6 per cent in May. This decrease was greater than the usual seasonal drop, and when the index is adjusted to allow for seasonal variation, the decrease is found to be 7.5 per cent. In the case of business and industrial buildings the floor space in contracts awarded shows a small increase which is largely seasonal in character. It is to be noted that in May the floor space in business and industrial buildings contracted for amounted to only 15.8 million square feet against 23.3 million a year ago.

Conclusion. Attention is again called to the fact that *declining building activity takes away an important support for industry and business.* If the movement lasts, building values will decline and financial difficulty result.

Trend of Trade and Finance

Prices Still Drop: Trade Activity Lessening

Exports and Imports

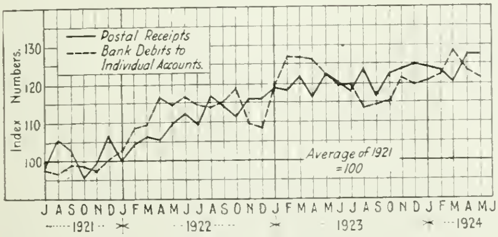
In May the adjusted index of imports fell from 150 to 148. And the adjusted exports index rose from 96.6 to 101. The excess of merchandise exports over imports was about 31 million dollars.

Bank Debits and Postal Receipts

Bank Debits. The adjusted index of checks drawn on banks during May fell 1½ per cent. (See Fig. 7).

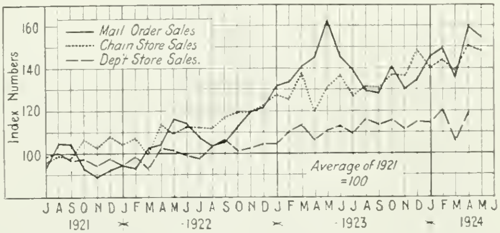
Postal Receipts. Receipts of the post offices at 50 selected cities remained practically unchanged during May, after eliminating the usual seasonal variation, and probably are at peak.

Conclusion. According to the indexes the volume of trade has changed but little from that of a year ago and in May was either at the peak or showed a decline. The index of bank debits is the more significant.



Sources, Federal Reserve Board; Post Office Department. Both curves corrected for seasonal variation.

FIG. 7 BANK DEBITS AND POSTAL RECEIPTS



Sources, Commercial and Financial Chronicle: Federal Reserve Board. Data cover 2 mail order houses, 4 chain stores, and 306 department stores. All corrected for seasonal variation.

FIG. 8 SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES

Retail Trade

The recession forecast for retail trade appears to have begun in May (Fig. 8).

Mail Order Sales. After adjusting for seasonal variation the index declined from 159.9 to 152.4—or 4.7 per cent.

Chain Store Sales. Sales of four leading chain store systems fell from 29.7 million dollars in April to 29.2 million dollars in May.

Department Store Sales. The index of department store sales in April stood at 119.7 against 105.9 in March. (The average for 1921 equals 100).

Conclusion. It seems that a further decline is likely in June and if such a decline comes it will be strong evidence of a distinct down-swing in the business cycle. Experience shows that the P/V line, Fig. 1, generally anticipates a change in the index of bank debits by about three months and that bank debits lead retail trade by about three months. A down-turn in retail trade, therefore, would be consistent with the past performance of these indexes.

Prices and Interest Rate

Prices. Bradstreet's price index, Fig. 9, on June 1, was down 2.1 per cent, all groups of commodities being lower. That index is now nearly 12 per cent below the peak reached in 1923 and 9 per cent over the average for 1921.

The sensitive six-commodity index showed a further sharp decline in May, all six of the commodities being lower. The index now stands at 105.2 against 110.2 a month ago.

Interest Rate. In May the New York rate on best commercial paper was 4¼ per cent. The index shown in Fig. 9 eliminates seasonal variation and is 64.6. (Average of 1921 is 100).

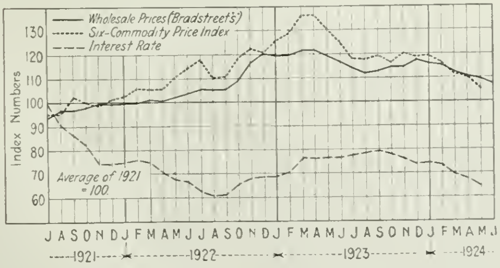
Conclusion. No general improvement in prices or firming of money rates is yet in sight. The decline in prices will probably go further.

New Enterprises and Failures

New Enterprises. The adjusted index shown in Fig. 10, which allows for seasonal variation, fell in May to 67.

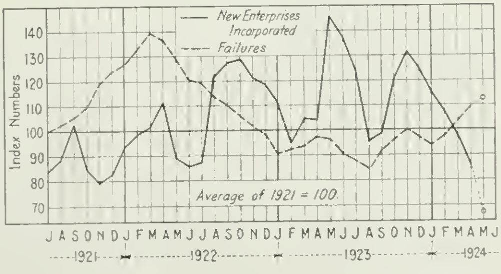
Failures. The Bureau's adjusted index of failures in May showed the fourth consecutive increase and was 112.6, or nearly 13 per cent over the average of 1921.

Conclusion. The foregoing facts reflect the slowing down of business and the declining rate of profits which are now in effect. No early up-swing is likely with increasing business failures.



Sources, Commercial and Financial Chronicle; Federal Reserve Board. Interest rate is the monthly average, corrected for seasonal variation.

FIG. 9 WHOLESALE PRICES AND INTEREST RATE



Sources, Dun's Review; New York Journal of Commerce. Both curves plotted as a 3 months' moving average, centered and corrected for seasonal variation.

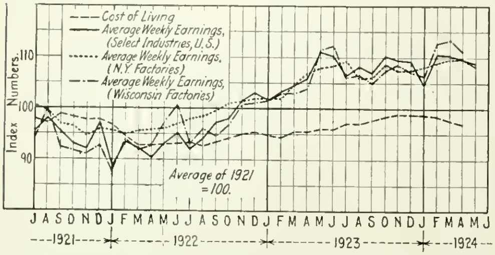
FIG. 10 NEW ENTERPRISES AND BUSINESS FAILURES

Wage and Employment Situation

Sharp Declines in Earnings and Employment

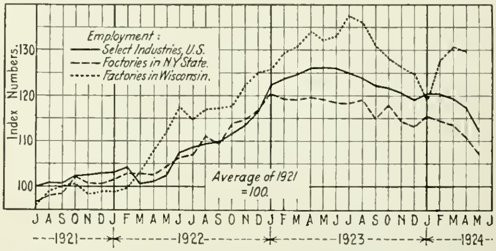
Earnings and Cost of Living

The course of average weekly earnings and the cost of living is shown in Fig. 11.



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin; National Industrial Conference Board. New York and Wisconsin curves corrected for seasonal variation.

FIG. 11 WAGES AND COST OF LIVING



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin. All curves corrected for seasonal variation.

FIG. 12 THE TREND OF EMPLOYMENT

Selected industries in the United States. The adjusted index of per capita earnings declined from 109.8 to 108.7 in May. Twenty of the 52 industries, however, showed increased per capita earnings in May; and 77 establishments reported wage rate increases, while only 48 reported decreases. Evidently the decline in earnings is due to decreased employment.

New York State and Pennsylvania. Actual weekly earnings in New York averaged $27.54 in May. The adjusted index decreased from 109.9 to 108.4, a drop of 1.4 per cent, which is a little lower than a year ago. In Pennsylvania per capita earnings declined 2.2 per cent.

Wisconsin. The index of the average weekly earnings of labor in Wisconsin, which is corrected for seasonal changes, dropped two points to 111.2 in April.

Cost of Living. In April the cost of living, as reported by the National Industrial Conference Board, decreased 0.8 per cent. The index now stands at 97.0.

Conclusion. Although per capita weekly earnings are definitely decreasing, they have not yet been much affected by the general industrial situation. It is clear, however, that labor's earnings have recently declined more rapidly than retail prices. This means decreasing purchasing power. On the other hand, hourly wage rates have changed little, the reduced earnings being caused by unemployment part-time work, etc.; consequently the employer is not benefiting.

The Employment Trend

United States. (See Fig. 12). The seasonally adjusted index decreased from 117.4 to 112.3 in May. The greatest decreases were in the East North Central Geographical Division and in the Middle Atlantic Division. In the Pacific Division the decreases were negligible, and in the Mountain States there was an increase of 3.5 per cent in employment during May.

New York State. The index declined from 110.8 to 107.2 in May. This is after allowance for the usual slight seasonal decrease in this month. During the past two months employment has been reduced over 7 per cent in New York State. It is now about 15 per cent below the level of May 1923, which was the peak of the recent upward movement. Employment in the clothing industry is especially low, greatly affecting the situation in the clothing centers of New York City and Rochester.

Wisconsin. In April the adjusted index decreased one point to 129.7. As shown on the chart, Wisconsin employment is holding up much better than either United States or New York employment. The Wisconsin index, in addition to reflecting conditions in a western state, is also different in that it includes other than factory workers.

Conclusion. All reports show decreases in employment. The indexes considered, however, are all well above the average for 1921. The New York index is 7.2 per cent above the average for that year, the United States index, 12.3 per cent above, and the Wisconsin index, 29.7 per cent above.

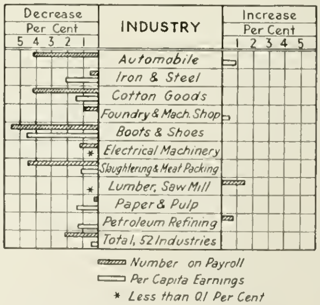


FIG. 13 TREND OF EMPLOYMENT AND EARNINGS, APRIL 1924

Employment and Earnings in Selected Industries

Fig. 13 shows the trend of employment and earnings in 10 leading industries during April.

Employment. Numbers employed in most of the industries analyzed fell off noticeably during April. Only two, sawmills and petroleum refining, showed greater employment, and these increases were comparatively small. The decrease in boots and shoes was 5.6 per cent. Automobiles, cotton goods, and meat packing registered declines in excess of 4 per cent. There was an average decrease of 2.1 per cent for the total of 52 industries.

Per Capita Earnings. The trend was decidedly downward, but not so pronounced as with employment. Only two industries analyzed, automobiles and foundries, showed increases. Both were less than 1 per cent. The largest drop was in boots and shoes, 4.6 per cent. The average decline for 52 industries was 0.4 per cent.

Immigration and Emigration

Migration both ways increased slightly in April. Compared with last year, immigration is smaller and emigration greater, leaving the net increase approximately 15,000 less than in April 1923. The actual figures follow:

Period	Immigrants	Emigrants	Net gain
April 1924..	38,375	5,394	32,981
March 1924..	35,585	4,202	31,383
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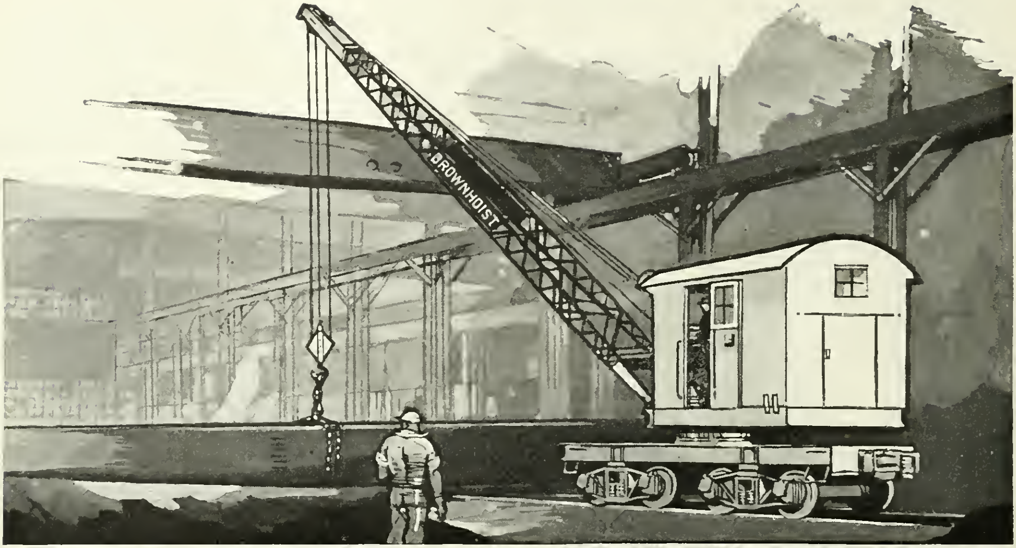

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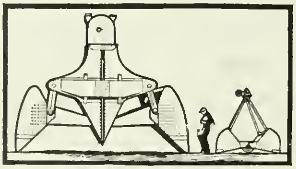

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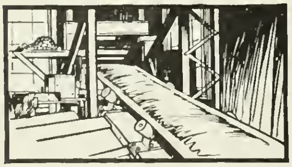

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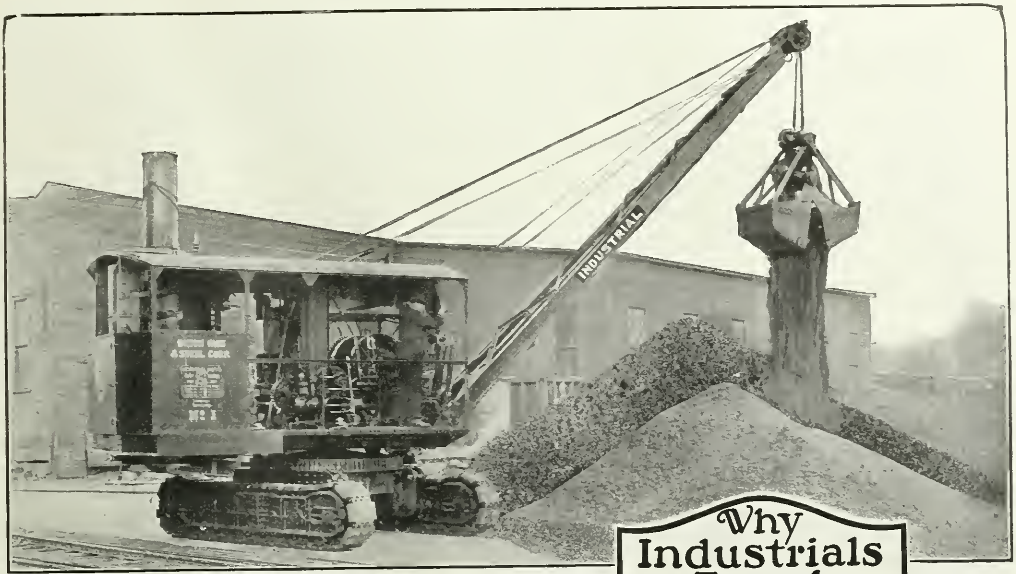

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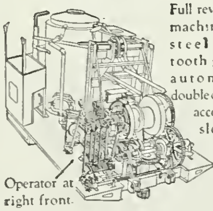

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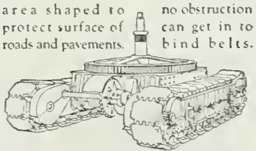

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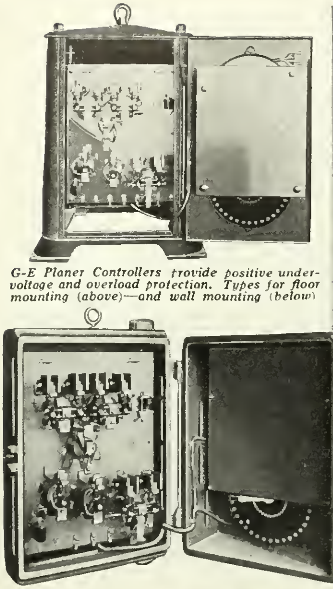

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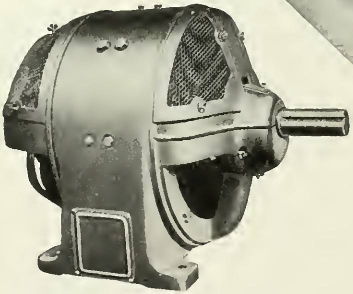

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GENERAL ELECTRIC

MANAGEMENT
AND
ADMINISTRATION

VOLUME VIII JULY, 1924 NUMBER 1

Unity in Management Policy

By WILLARD E. HOTCHKISS

Executive Director, National Industrial Federation of Clothing Manufacturers

Index Number
658.1 Executive control

DURING the past 15 years it has been my lot, either as participant or as spectator, to observe the working out of policy in a number of concerns drawn from several industries. It is impossible to come away from such an experience without being impressed with the frequent absence of consistent policy and with the failure of many concerns to keep practice and procedure in line with policy nominally in force.

Thoughtful executives all know that unity of policy, harmony of procedure, consistency of practice, are ear-marks of good management. Why is it, then, that so frequently they fail to achieve these ends? Possibly the first answer that occurs to a person who has studied individual concerns in practical operation is conflict of interests and purposes within management itself. In the extreme case, as when there is a main corporation with subsidiaries, or distinct major and minor interests, or interlocking representation in the management of two or more concerns, a person whose major business interests are elsewhere may hold an executive position with a company and be able to use it to advance outside ends.

W. E. Hotchkiss

But these cases of economic vassalage are not the only ones in which persons on the inside of management are moved by special interests. Modern business can function only through organization. While it is still possible in almost any type of business for major decisions to be made by one man, or by a small group, that can act in harmony, in any highly organized concern the councils upon which decisions rest, as well as the action involved in carrying them out, must ordinarily take in people who stand in varying relationships to the business as a whole. Such persons are likely to approach questions from a viewpoint which is quite different from that of the central management, and many of them, irrespective of outside connection, have interests at stake that diverge widely from the general interests of the business. So it comes about that management is all the time receiving the impact of forces that strike it at a tangent. The resultant of these forces affects both the course which management will lay out and its success in holding to that course in actual operation.

It frequently happens that the persons who are most aggressive in advancing their special interests are most firmly convinced that these interests are also the interests of the business. In many instances a person himself may not know when he is being actuated by some special interest. The manner in which he gathers and interprets data, the way in which he gives or executes an order, the kind of co-operation he obtains from those who work with him, the elements, in short, that go to make up his part in an enterprise, may all be colored, consciously or unconsciously, by the individual, professional, local, or departmental slant from which he goes at his task.

A striking case in point recently came to my notice in a coal company that operated several mines. An exceptionally forceful mine superintendent was in the habit of being consulted about general production and labor policy, and it was, of course, his duty to enforce at the mine the policies adopted by the central management. His own observations about policy and procedure and the record of operation for his mine showed conclusively that the language he used in giving advice or in supporting general policy, as well as the interpretation he placed on instructions, always meant to him the continuance of his existing practice at the mine; language to convey any other meaning simply did not exist for him. In the absence of a strong central control he continued to put his own meaning in language and continued to do as he pleased. Similarly disruptive of general policy are orders from the top that emanate from an imperfect grasp of local conditions. When this happens it cannot but foster a mental attitude like that of the mine superintendent.

Lack of unity that results from faulty co-ordination within management personnel appears on the surface to be less a matter of policy than of administrative control. But poor control and unstable policy are likely to go together; laxity of control will ultimately undermine any policy, while with weak or vacillating policy control becomes practically impossible.

Instability of policy may be a matter of incompetence or thoughtless drifting, or it may arise out of the failure of management to find a working adjustment between short-time and long-time objectives. Management always has the task of maintaining some sort of stable balance between the trader instinct, intent on maximum present advantage, and the producer-investor instinct, solicitous to safeguard long-time welfare and stability.

Since 1914 an important factor in the success of many concerns has been the wisdom shown in buying materials. There occurs to me in this connection the experience of two companies in the same trade. The first company at the outbreak of the war plunged to the limit of its capital in the purchase of materials at pre-war prices. This proved to be a brilliant stroke and the company has since utilized its strong position to maintain a high degree of stability in production and merchandising policy. The second company, one that occupied a much more important position in the industry, found itself stocked with high cost materials when the market declined at the time of the armistice, and then depleted its stores and had to re-stock after the subsequent rise. Two wrong guesses by the management of this company contributed mightily to a crisis, a year or two later, that came very near to bringing about a liquidation of the business. These two cases reflect equally an excessive domination of the trader instinct. They are examples not of business policy but of speculation.

The extent to which trading, more or less speculative, enters into the normal processes of a business, depends, of course, upon the nature of the business, but there is always danger that management will be carried away by the trading impulse and when this happens stability of policy is sure to be undermined.

The danger from the trader's short-time view of policy shows itself in a subtle and peculiarly perilous form in the commercial intoxication associated with business booms. During the past few weeks I have had occasion to co-operate with the management of an old and highly respected concern in an effort to reduce the unit cost of manufacture. Since the business slump of 1920 this company has been struggling with increasingly adverse conditions and has lost an appreciable part of its capital. Much of its trouble is traceable to its having been beguiled by inflated demand into making an addition to plant which was completed practically at the end of the 1919 boom. Besides the burden of carrying the investment, excess capacity has had an adverse influence on piece rates, on the balancing of shops, on supervision, in short, on nearly every phase of manufacturing cost, not to mention its reaction on the pricing of lines and other phases of merchandising and sales. The difficulties of this concern have been enhanced by certain burdens that are beyond the scope of its own policy and it is not yet clear how its situation will be met. Except, however, for the unhappy expansion at the crest of the wave, it is altogether probable that the other burdens would have been successfully carried.

The resistance of customers to sales effort in dull times subjects policy to strain of a different sort. Producers of many kinds of competitive merchandise have found it impossible for a good part of the time since 1920 to sell goods to their regular customers in normal amounts and at customary prices. The decline in consumers' incomes has stimulated competition on a price basis and made it fall hard on quality merchandise in the higher price ranges. Unable to escape from the dilemma of loss through small volume and consequent high unit overhead, or loss through volume sold at an inadequate margin, management is under pressure to offer goods of poorer quality.

Unless such deviation from established policy is carefully safeguarded it involves at least two serious dangers: first, there is pressure to mark the cheaper merchandise too close, in which case a firm may find itself competing less with its competitors than with its own more wisely priced lines. A second and more serious hazard is injury to reputation. In an effort to forestall a temporary loss a company may easily undermine the value of large investments in advertising and sales effort made to establish a demand for quality merchandise. This is a kind of hazard that wise management, financially strong enough to carry a temporary loss, should be extremely reluctant to assume.

Relations with employees constitute a phase of management in which many otherwise well-managed concerns have shown great fluctuations of policy. Discussion of the different approaches from which efforts to stabilize industrial relations are being made would carry too far afield, but it is significant that the more thorough and far-reaching the effort of management to incorporate industrial relations within the scope of unified and consistent policy, the more obvious has become the loss from lack of unity in the other phases of management. With stable production and sales policy an industrial relations problem may be comparatively simple, and yet become unsolvable when these other phases of management are surrounded by uncertainty. There is no point at which stability of policy counts for more than it does in dealing with employees.

Changes in Equipment and Product Preceding Installation of Production Control

Building Tractors Under Scientific Management—II

By GEORGE D. BABCOCK

Manufacturing Executive, Holt Manufacturing Company

As related in the preceding article of this series,[1] at the beginning of 1919 a supply of army tractors was taken over from the government out of the orders that were in process at the time of the armistice. This was for the purpose of making available at once a supply that might possibly be used for industrial purposes, while a tractor that was especially adapted to industry was being developed. It was not known whether or not the military tractor could be converted into a commercial article, and the first study to be made was what changes, if any, were necessary in design in order to make it fit the new requirements.

Development of the Industrial Tractor

The tractors were put in service under all conceivable conditions, devised to test their ability to do their work. Some were sent to the logging camps in the North; others to logging in the swamps of the South. They were tested on roads and in fields, in snow, in mud, and in water; over rocks and in sand. The tests clearly demonstrated that the military design required considerable overhauling before it would serve as a commercial machine.

This situation added immeasurably to the difficulties of bringing the manufacturing under absolute control. Many engineering changes were indicated as necessary in the design of the tractor in the year 1919. All of these required some modification in the shop work. Some of them necessitated entirely new patterns and drawings. A change in one item frequently would necessitate changes in several others. Then, too, there was no assurance that any change would be final.

It can readily be appreciated that this constant change in design enormously increased the work of the shop. The getting control of production demanded absolute knowledge of the time required for the procurement of material, and of the time required for machine work and for assembly of each and every part entering into the finished tractor. This meant that a detailed analysis of the shop operations had to be made, and also a study of the material market, for every single part. Even had the military tractor proved entirely suitable for commercial purposes, these analyses would have been a large order. When it is considered that many parts were subject to change on each lot of tractors that were put through the shop, it can be realized that absolute control would be indefinitely postponed until the engineering design was more thoroughly standardized.

Index Number
658.9:629.113 Tractor Manufacture.
Management.
658.5 Production control

Another obstacle to complete control was the condition of the parts of tractors that had been under contract by other manufacturers at the time of the armistice, and which had been taken over by the Holt Company. These, it will be recalled, were in every stage of completion, and had been made in different shops by different methods. Furthermore, but one set of tools was available, so that the tools had either to be made or adapted for about half of these parts. The available tools, too, had not been made for the Holt shop equipment, and they had to be adapted to the Holt machines. To attempt a detailed analysis of the work necessary to complete these unfinished parts was an almost hopeless task. It promised also to be an unprofitable one, for the reason that the changes in design, that were by this time beginning to be made, would render these parts obsolete for future tractors, and hence make obsolete the methods of making them.

It seemed best, therefore, not to spend too much time in the form of permanent studies and records, but to make rough estimates of the time and labor required for each lot of tractors to be built from these parts. From these estimates tentative schedules of production were built up, which were adhered to as closely as possible. By keeping a close watch on the group assemblies, noting those parts that were short or were lagging behind in the machine shop, and by making up shortage lists of these parts, upon which attention was concentrated, production was kept reasonably close to the schedule. These shortage lists were made up at rather frequent intervals, in order that no group of parts would fall very far behind and thus delay completion of the lot of tractors which were already under construction.

Comparative Advantages of the Two Methods

This method of manufacture is effective. It is, however, expensive in time and labor, and uses up more nervous energy than it is worth, for the same results can be obtained much more easily and with greater precision by the methods of scientific management. It is also disconcerting to the shop, since urgent shortages that must be made up promptly, frequently necessitate the breaking down of machine set-ups in order to make one or two parts. This results in a delay and possible shortage on the next lot in process, and thereby aggravates the situation. It may be noted here that the methods described above are not at all uncommon in manufacturing. In fact, they are the ones usually employed in plants that are not operating under scientific management.

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[1] See MANAGEMENT AND ADMINISTRATION, June 1924, p. 647.

Another factor that delayed the gaining of control was the question of what were known as "government spares". At the time of the armistice, the government had on order a considerable volume of spare parts for repair of military tractors. These orders were not canceled, and both the government and the Holt Company were anxious to have these parts made and out of the way as soon as possible. The volume of work for these spares was large enough to warrant treating it as a separate manufacturing problem, and to set aside a definite part of the personnel for this purpose. It was also determined that a daily schedule of production should be drawn up, and every effort made to adhere to this schedule.

A remarkable feature of this schedule, and one that made the successful meeting of it especially noteworthy, was that it was laid out on the basis of a definite value in dollars of work to be completed daily. It is unnecessary here to enter the reasons for making a schedule on this basis, but the advantages of so doing were so much greater than the disadvantages from the shop standpoint, that it was the logical course to follow. A standard of minimum and maximum values of parts to be delivered daily was fixed. The degree of control that was established over this part of the production program is well illustrated by the curves of Fig. 9.

The method followed in meeting the schedule was to pick out, from the parts on order, a sufficient variety and volume for each day to fall within the limits of value previously adopted. The progress of these lots through the shop was carefully observed, and by means of shortage lists, parts which were falling behind were expedited. If it became apparent that certain parts were impossible of completion by the date set for their delivery, other parts were substituted from lots due on a later date, in sufficient volume to make up the required value. The parts that were behind were then assigned to a later date, and a balance was thus maintained between the limits set.

All of the work that has been described above, may be considered as a clearing of the decks. Meanwhile, the engineering work on the commercial tractors had been steadily progressing, and their final form was beginning to take shape. As this became apparent, and an analysis of the product was made, the outlines of the permanent routine for efficient manufacturing began to appear, and plans were laid to establish this routine. Several distinct problems presented themselves as requiring solution. Among the most important ones from the production standpoint were:

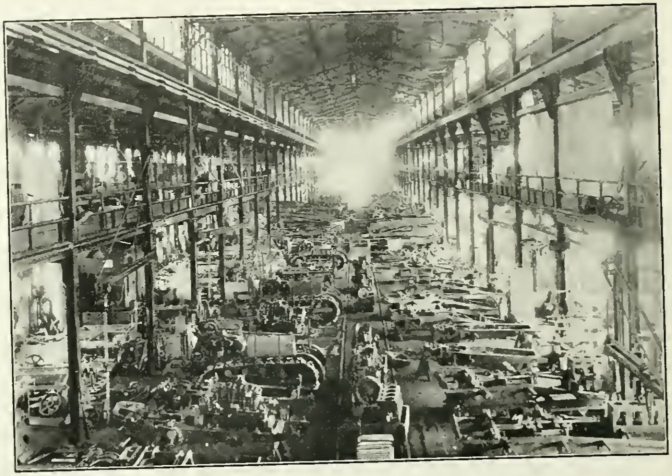


Fig. 7 Final Assembly Floor at Close of the War

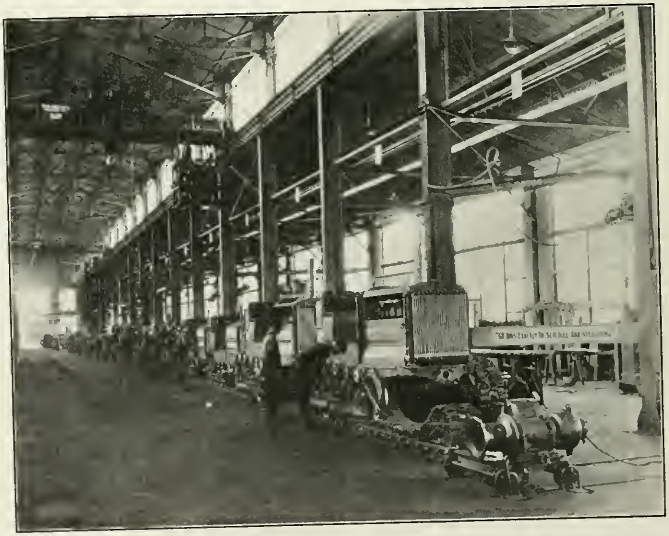


Fig. 8 Final Tractor Assembly in Which Exact Production Has Been Maintained for 611 Days

1. The establishment of an adequate material control.
2. The rearrangement of the shop to insure a straight-line flow of material.
3. The standardization of machine operations.
4. The standardization of machine equipment to enable work to be routed to a group rather than to an

individual machine to facilitate progress of work.

5. The establishment of definite routing for every part manufactured.
6. The building of schedules to insure that every part would be started in the shop in ample time to be delivered for assembly at the time it would be needed.
7. The design and manufacture of special tools and fixtures to make possible the most economical methods of machine work.
8. The devising of dispatching and timekeeping methods that would insure a steady flow of work in accordance with the schedules.
9. The development of the inspection function to a point where the percentage of imperfect work would be reduced to a minimum by detecting errors in workmanship before an entire lot of parts had been spoiled.
10. The development of the toolroom and toolroom system that would insure each workman a complete and adequate set of tools for each job as soon as he needed them.

Another problem that presented itself was the development of proper relations in the personnel of the plant. This problem, however, was of a different character than those outlined above, and its solution depended largely upon the success with which the mechanical problems were solved.

Establishment of Material Control

In the establishment of an adequate material control, several features were recognized as requiring immediate attention. The first of these was the establishment of storerooms, both for rough stores and for worked materials, including finished purchased parts. These storerooms, it was recognized, should be under direct control, and the individual in charge of them should be held responsible for the material delivered to them. At the time of the armistice such storerooms as existed were accessible to any one in the plant. This condition alone made it impossible to keep accurate records and obtain control over the material. The first step, then, was the selection of a location and the inclosing of the storerooms. Bins for castings and finished parts were erected, racks for steel and other bar material were constructed, and the storerooms themselves were made accessible only to those employees who actually were a part of the storeroom force.

A system of control ledgers was established to show at all times the amount of each item of material on hand in the storeroom, and the requirement was laid down that no material should be received in any storeroom unless accompanied by the proper documents to show its origin and for what purpose it was to be used. On the other hand, the requirement was also laid down that no material should issue from the storeroom except upon presentation of requisitions or stores issue slips authorized by a material control division which was established at an early date. The purpose of these regulations was to insure that nothing could enter or leave the storeroom without the appropriate notation being made in the balance ledgers.

This sounds like a simple problem, and one that should be comparatively easy to solve. On the contrary it proved to be an extremely difficult one, and one which for a time seemed almost impossible of solution. The personnel available seemed unable to grasp the fundamentals of storekeeping. Several individuals were tried on the job, but periodic checks invariably showed the ledgers out of balance with the actual quantity of material in the bins. It was not until J. E. Murphy, who had been with the material control department at the Franklin plant, was put in charge of this work, that anything like control of the material was obtained. This took place early in 1920. From that time on, the situation rapidly improved until today the control may be said to be absolute.

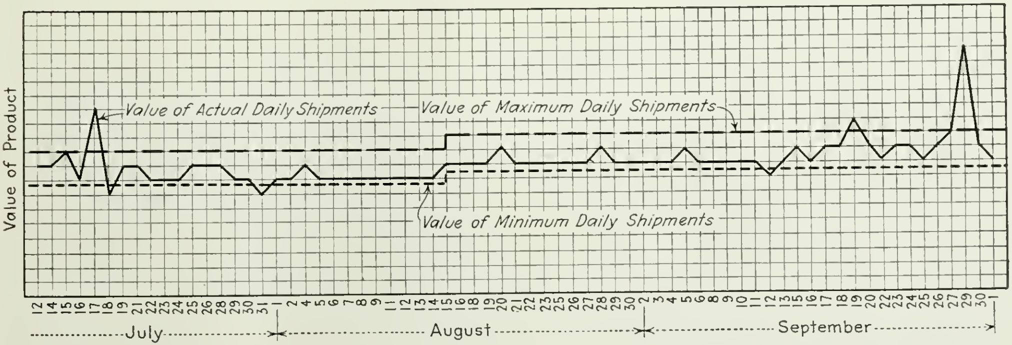


FIG. 9 CONTROL CHART SHOWING VALUE OF PRODUCT SHIPPED DAILY

This trouble in obtaining control of the materials illustrates one of the difficulties in applying scientific management to any organization where there has been no previous idea of these principles. Although scientific management is largely a combination of plain common sense and the application of scientific principles, it seems almost impossible to find, where scientific management has never been used, habits of thought that will co-ordinate these two items. It seems necessary at the start, at least, to put in charge of each of the major functions, someone who has had previous experience in these functions.

Once the ledgers had been brought into agreement with the actual materials on hand, it became a comparatively easy matter to hold them in this condition. This was a long step in advance in the establishment of the desired control. The ledgers showed not only the material that was actually in the shop, but also material that was on order, and material which had been apportioned or reserved to particular lots actually in process or about to go into work in the shop. If items were found missing at assemblies, it was no longer a question of whether or not material was available to make the missing part, but a question of where in the shop, between the storeroom and the assembly, the missing parts would be found. In other words, bringing the material under control had removed one possible source of failure. Since scientific management is, in effect, a running down and correcting of all the causes which prevent perfection, the permanent removal of any one cause makes the balance of the problem just that much easier. Therefore, when each milestone on the path of progress is reached, every effort should be made to prevent any slipping back. The material control was one such milestone.

Routing and Machine Standardization

Referring again to the program of problems requiring solution, items 2, 3, 4, and 5 were of necessity considered together. The establishment of definite routing depended somewhat upon the arrangement of machines in the shop. It also depended upon standardized machine operations. Machine operations were impossible of standardization until the equipment itself was standardized. Here again difficulty was encountered with the personnel available to solve this group of problems. Again it was a case not of unwillingness or lack of intelligence, but a lack of the background of the application of scientific management, and lack of training in the operation of its functions. The individuals who failed to solve the problem in 1919, could in all probability solve it easily in 1924, in a similar situation, providing they had remained at the plant and grown up with the system under the instructions of a man familiar with it. At this juncture, recourse again was had to a man who had been trained at Franklin.

E. J. Terry had there worked his way up through the shop, and made time studies. The time-study work had led to devising of better methods in the shop, including the tooling of machines. Then he had posted the control boards, which directed the flow of work through the shop. This was just the sort of experience that the situation at Peoria called for, and Terry accordingly became a member of the Holt organization.

The job was a complex one. The best way of machining the several thousand parts entering into the construction of tractors had to be studied, and tools and fixtures for doing the work had to be designed in many cases. Then in order to fix the time in which these jobs should be done, it was necessary to specify the best combination of speeds and feeds for each operation. Before this could be done, it was necessary to learn whether or not the combinations that were best were available in all the machines to which the work might be routed. A survey of all the machines in the shop was the only way in which this information could be obtained. Fig. 10 is typical of the data sheets that were prepared as a result of this survey.

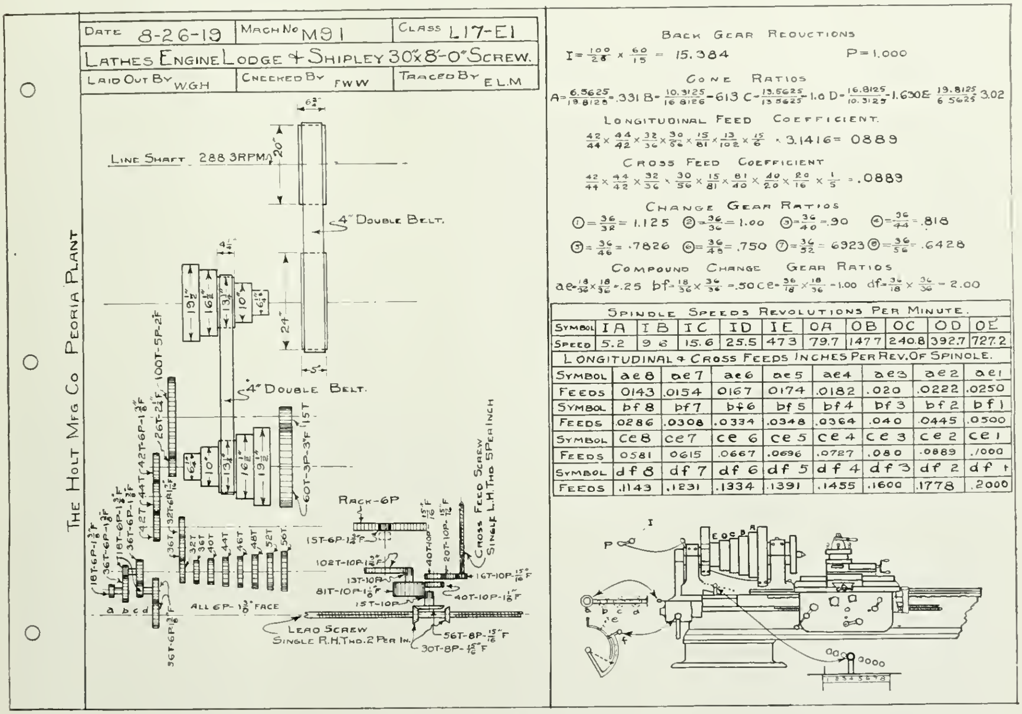
When these data were gathered, machines of the same type and class were compared to ascertain whether or not the desired combinations of speed and feed could be obtained on all of them. If necessary, changes were made in some machines to bring them into line with the others. The importance of this point cannot be too strongly emphasized. If the machines of any one class have different speeds and feeds, it becomes necessary to route work to a particular machine. This may result in a congestion of work at one or two machines, while others in the same group were standing idle. If the latter are utilized, they will necessarily have to work at a lower rate of output than the job analysis calls for, with a consequent failure to meet the schedule. On the other hand, when all machines of a class are of the same capacity, the work may be routed to the group, and put in the first one of the group that finishes the job it is working on. This immeasurably simplifies the routing, and makes the dispatching of work in the shop much more rapid.

Finally, when the routing was decided, the arrangement of the shop was taken up. The ideal arrangement is one where raw material enters at one end and progresses in a straight line to the point of assembly. This ideal can be attained only in a circular shop, with material moving radially from the outer circumference to the center, which is the assembly point. A close approach can be made to the ideal if the material enters at one end of a shop, moves in a straight line to the first operation, and thence straight through the various machines to the final operation. Thence another straight-line movement takes it to finished stores or assembly. In any event there must be no retrograde movement for any machine operation. This was the condition it was sought to realize so far as possible in the rearrangement of the Holt shop. Fig. 11 is a plan of the machine shop showing the present arrangement of machines. It will be observed that the various types of tools are arranged in several groups in various locations, and that similar groups will recur at several places in the same line. Thus in rows 5 and 6 in the upper half of the drawing, bays K to B contain first, some horizontal and vertical milling machines, then some radial drills, next some horizontal boring machines, followed by another group of radial drills and then by some more boring machines. These same types of tools appear in different sequences in other parts of the shop. This arrangement was dictated by the sequence of operations on the parts that are machined in these bays. Should a new model of tractor be developed, requiring a different sequence of operations, the machines would be rearranged for this sequence. It is too frequently assumed in most shops that moving machinery is too formidable a job to be attempted, and the work is routed to fit the shop, rather than the shop adapted to fit the work. That this is a fallacy will be realized when it is considered that for a standard line of product, the machine movement occurs but once, while the unnecessary movement of material is a constant and continuous expense. The loss due to this unnecessary movement will usually be far greater than the cost of rearranging the machinery.

It is, of course, impossible in most shops fully to realize the ideal of straight-line movement of material. Only where the product is in such tremendous volume that the whole time of a man will be spent on a single operation on a single part, will the expense of the equipment necessary be justified. Hence while as large a proportion of the work as possible was routed through groups of machines, a considerable portion of the equipment was departmentalized, and part of the work was routed to departments. This involved some retrogression, but a constant effort was made to bring this to a minimum.

The Development of Schedules

Up to this point the work dealt with the making of the individual parts. Control, however, would not be complete until the parts were considered in their relation to each other and to the assembly. This required the development of schedules which would indicate the time that each subassembly should be completed, in order that the finished tractor could be delivered upon the date desired, and the dates upon which each part entering into the subassembly should pass a particular operation in order to be ready for the subassembly when needed. Building of schedules for the individual parts is not a matter of great difficulty when accurate knowledge is available concerning the time required for each operation. It simply becomes a matter of totaling the operation time and allowing a sufficient interval between operations to permit of inspection, if this is necessary, and to move the material to the next operation. The grand total then indicates the number of days prior to the delivery date for the parts that work should be started in the shop. One point, however, must be observed in this connection. The total amount of work assigned to a given group of machines must not exceed the average machine capacity available. This overloading of machines is avoided by means of a machine burden record, which is elsewhere described. If it indicates that the machine capacity is exceeded in any given time, the capacity is increased, or working time is lengthened, by additional shifts.



THE HOLT MFG CO PEORIA PLANT

DATE 8-26-19	MACH NO M91	CLASS L17-E1
LATHES ENGINE LODGE & SHIPLEY 30"x8'-0" SCREW.		
LAID OUT BY W.G.H	CHECKED BY FWW	TRACED BY E.L.M

BACK GEAR REDUCTIONS

$I = \frac{100}{28} \times \frac{60}{15} = 15.384$ $P = 1.000$

CONE RATIOS

$A = \frac{6.5625}{19.8125} = .331$ $B = \frac{10.3125}{16.8125} = 613$ $C = \frac{13.5625}{13.5625} = 1.0$ $D = \frac{16.8125}{10.3125} = 1.630$ $E = \frac{19.8125}{6.5625} = 3.02$

LONGITUDINAL FEED COEFFICIENT.

$\frac{42}{44} \times \frac{44}{42} \times \frac{32}{36} \times \frac{30}{56} \times \frac{15}{81} \times \frac{13}{102} \times \frac{15}{6} \times 3.1416 = 0889$

CROSS FEED COEFFICIENT

$\frac{42}{44} \times \frac{44}{42} \times \frac{32}{36} \times \frac{30}{56} \times \frac{15}{81} \times \frac{81}{40} \times \frac{40}{20} \times \frac{20}{16} \times \frac{1}{5} = .0889$

CHANGE GEAR RATIOS

① $= \frac{36}{32} = 1.125$ ② $= \frac{36}{36} = 1.00$ ③ $= \frac{36}{40} = .90$ ④ $= \frac{36}{44} = .818$

⑤ $= \frac{36}{46} = .7826$ ⑥ $= \frac{36}{48} = .750$ ⑦ $= \frac{36}{52} = 6923$ ⑧ $= \frac{36}{56} = .6428$

COMPOUND CHANGE GEAR RATIOS

$ae = \frac{18}{36} \times \frac{18}{36} = .25$ $bf = \frac{18}{36} \times \frac{36}{36} = .50$ $ce = \frac{36}{18} \times \frac{18}{36} = 1.00$ $df = \frac{36}{18} \times \frac{36}{36} = 2.00$

SPINDLE SPEEDS REVOLUTIONS PER MINUTE.

SYMBOL	IA	IB	IC	ID	IE	OA	OB	OC	OD	OE
SPEED	5.2	9 6	15.6	25.5	47 3	79.7	147 7	240.8	392.7	727.2

LONGITUDINAL & CROSS FEEDS INCHES PER REV. OF SPINDLE.

SYMBOL	ae 8	ae 7	ae 6	ae 5	ae 4	ae 3	ae 2	ae 1
FEEDS	0143	.0154	0167	0174	.0182	.020	.0222	.0250
SYMBOL	bf 8	bf 7	bf 6	bf 5	bf 4	bf 3	bf 2	bf 1
FEEDS	.0286	.0308	.0334	.0348	.0364	.040	.0445	.0500
SYMBOL	ce 8	ce 7	ce 6	ce 5	ce 4	ce 3	ce 2	ce 1
FEEDS	0581	0615	.0667	.0696	.0727	.080	.0889	.1000
SYMBOL	df 8	df 7	df 6	df 5	df 4	df 3	df 2	df 1
FEEDS	.1143	.1231	.1334	.1391	.1455	.1600	.1778	.2000

FIG. 10 TYPICAL MACHINE ANALYSIS

Notwithstanding the comparative simplicity of this phase of the work, the amount of study and of clerical labor involved in preparation for scheduling was large, and quite some time elapsed before complete schedules could be built up for the entire product. The constant changes in design, which were taking place during the first two or three years after the armistice, rendered necessary frequent changes in operation schedules with their consequent effect upon the schedules for the product as a whole. However, early in 1920 schedules

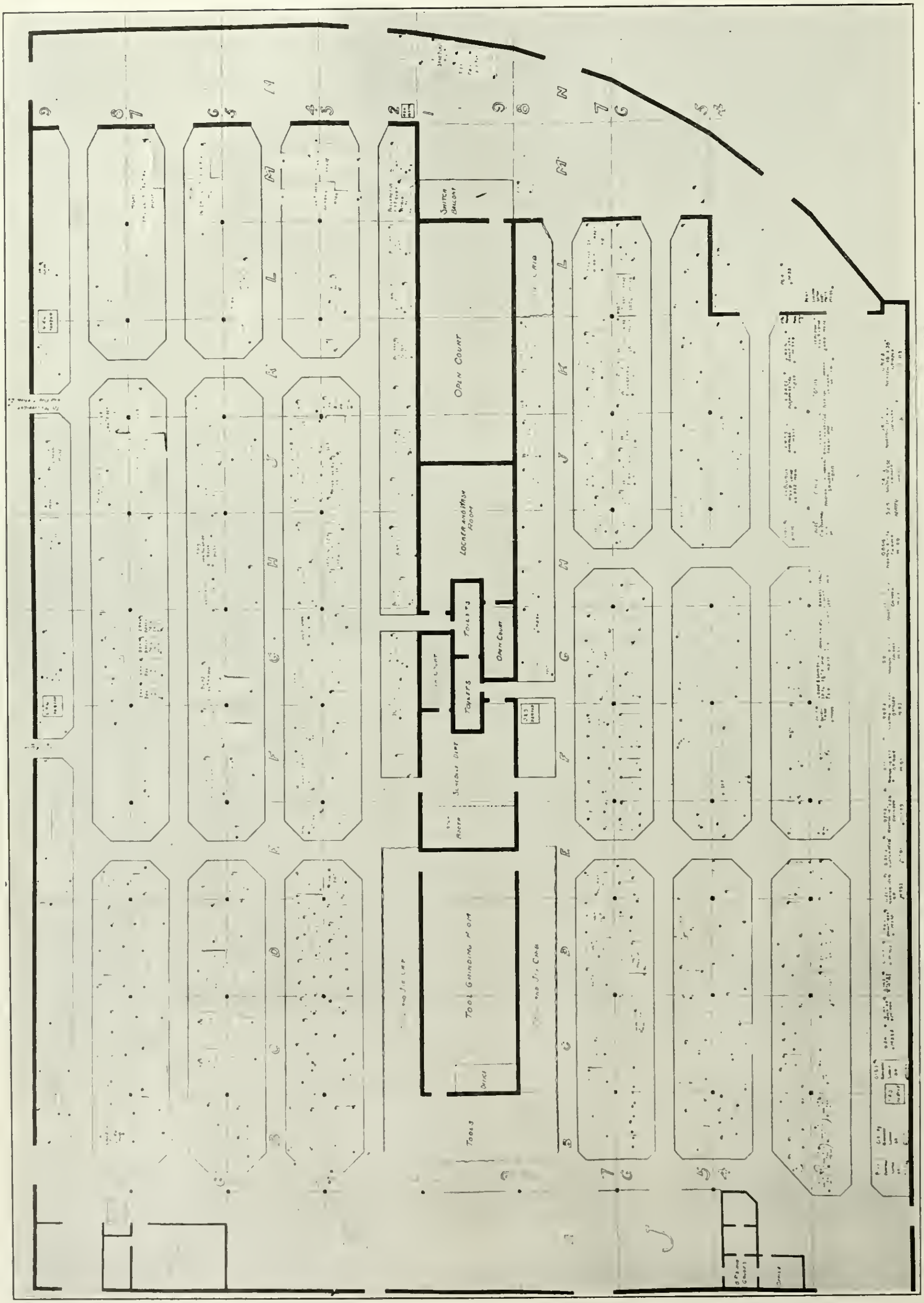

Open Court
Locker and Wash Room
Toilets
Open Court
Toilets
Switch Balcony
Tool Grinding Room
Office
Tools

FIG. 11 PHOTOGRAPH OF PLAN OF MACHINE SHOP SHOWING THE PRESENT ARRANGEMENT OF MACHINES

were fairly well formulated, and control began, and the degree of control that was obtained became noticeable. From May 28 to September 16, 1920, a period of 90 working days, a daily task was exactly met. Production was stopped on the latter date in order to introduce a number of engineering changes. On January 24, 1921, control was again established and a daily task was set and maintained exactly until May 6, 1921, a period of 82 working days. Then production was stopped by the business depression. On January 18, 1922, a new tractor schedule was set calling for the first delivery of tractors on March 18, 1922. This schedule has been followed by others calling for varying numbers of tractors per day, and these several schedules have been exactly met without interruption up to June 2, the date of this writing, or a period of exactly 620 working days.

The three problems on the list of those to be solved before absolute control could be obtained, that have not been discussed, were minor, although important, phases of the control.

Prompt Dispatching Necessary in Efficient Shop Operation

Prompt and accurate dispatching was a prerequisite of efficient shop operation. Before this was obtained it was necessary to educate both the men in the dispatch cages and the shop force as a whole. Again it was a question of personnel, and many men were tried before a dispatch crew, that would work in entire harmony with the shop and with the routing department, was obtained. Some of the difficulties that were encountered and which could be recognized, were faults in personnel rather than faults of the system used. They were as follows:

Job cards would be taken home or locked in tool boxes by the workmen instead of being returned to the crib. Information as to what had been finished and what had been rejected in a given lot would be marked on the ticket. Identification tags would be lost or placed on the wrong part. Move tickets would be lost, with the result that the movement of material would not be recorded on route sheets, thus indicating that the work was ready for the next operation. Jobs would be issued to be run on one machine, but the workmen would set it up on another which happened to be standing idle. This led to confusion, as the machine might have been assigned to other work which would come along after the first job had been started. Little co-operation existed at first between the workmen and the dispatch cages, and less existed between the foremen and the cages. The foremen seemed to feel that the cages were responsible for lowering their prestige and derogating their authority. A long campaign of education was necessary before the above troubles and many others were eliminated.

The details of the system of dispatching finally adopted will be discussed in a later article. Our purpose here is only to show the work that was necessary before what might really be termed a fairly close approach to scientific management was attained.

Routing, dispatch, and material control, including purchasing, were materially simplified by a reduction in the variety of raw materials that were purchased. At the beginning of the work, many types and classes of steel and other metals were requisitioned and bought. Some of these were well suited for their purpose, and others not so well suited. A metallurgical laboratory was established, the purpose of which among other things, was to work in conjunction with the engineering department to reduce the varieties of steel and other materials entering into the construction of the tractor. Steels had been specified for different purposes which varied but little in chemical composition and physical properties. Investigations were made and showed that many varieties of steel could be replaced with one steel whose properties were such that the substitute often was better adapted to its purpose than the original. Reducing the number of steels, reduced the number of speeds and feeds which had to be figured for different parts, since feeds and speeds depended in a measure upon the material. Instead of 12 steels which were purchased for tractor construction in 1919, the number of varieties was brought down to four in 1922. Another instance is that gages of copper tubing in 1919 were reduced to three gages in 1922. Similarly, attention was concentrated on purchased finished parts, with the result that the number of varieties of cap screws, cotter pins, and standard hardware, was greatly reduced. This not only simplified the stores and routing, but affected a considerable reduction in the amount of material carried on inventory.

Inspection

The inspection of material in process and of finished parts was a function that was operating efficiently at the time of the armistice. It, however, was necessary to tie this function in with the others, and to establish a routine which would insure the detection of errors in shop work before that had gone far enough to cause a serious loss. It was arranged that inspectors should inspect the first piece in each lot at the beginning of each operation on the piece. If errors in tool-setting or workmanship were such as to render the piece inacceptable, the necessary corrections were indicated by the inspector, and inspection was continued until the workman had turned out a perfect job. The second inspection took place upon completed lots of parts, and was done in an inspection department equipped with the necessary gages, templets, and measuring instruments. To insure the first piece being inspected, provision was made on the job tickets for the inspector's signature and the burden was placed upon the workman of finding the inspector and having him pass upon his work before he proceeded. To get inspection operating in conjunction with the rest of the routine, was principally a matter of education since the shop already was accustomed to the necessity of inspection.

The situation that existed at the beginning of 1919 in regard to the issue of tools, was much the same as existed in regard to stores. The tool cribs were accessible to any one in the shop, and really served only as a source of primary supply for the men. Many tools were issued from the cribs, but few were returned. The first step that was taken was to enclose and lock the tool cribs, admitting to them only those concerned with their operation. The next was to collect all the tools that had accumulated in the shop during the war, and return them to the cribs. Tools were found under benches, in bench drawers, in workmen's tool boxes, under machines, and in many extraordinary places. When they were all gathered and returned to the tool crib, it is hardly an exaggeration to say that several wagon loads of small tools had been recovered. Once these tools had been returned to the crib, they were sorted, a tool classification adopted, and tools stored in accordance with it. A grinding-room was established in conjunction with the tool crib, as shown in Fig. 10 and arrangements made to grind all tools in this grinding-room for the shop. A system of inspection was established whereby all tools used were inspected as soon as they were returned from the shop, and those in need of it were sent to the grinding-room for sharpening. It is now a matter of pride that a visitor to the plant is unable to find a dull tool in any of the storage racks of the toolroom.

The foregoing is a brief outline of the things that had to be done in conjunction with the physical conditions of plant and product before any attempt could be made to establish absolute control of the work and before the shop could be said to be operating under scientific management. About the middle of 1920, the preliminary work had progressed to a point where definite control began to be established. From that point on, the work largely consisted in developing the methods to obtain more perfect control, and to shortening the time of operation and making the personnel more efficient.

THE next two articles will describe the development of the personnel, and the routine that was established to carry out the principles of scientific management. —THE EDITORS.

Applying Conveyors to Laundry Service

Index Number
658.9: Laundry. Management

THE marking room of the Metropolitan Laundry is one of the largest and mechanically most perfect marking rooms in the world. The plant has two upcoming conveyors to carry the bundles of soiled laundry to the operators.

After the bundles are marked, which is done by the man in the foreground, they are laid on the conveyor, controlled by a push button. When the first bundle travels to the end of the conveyor it touches a screen, which automatically stops the conveyor.

There is a high shelf running the entire length of the fourteen booths. On this shelf the operators lay all pieces which are to have a label or a patch sewed on. Garments such as table cloths, and all colored pieces, contain slips of paper with the laundry marks on them. One girl sews on the patches and marks them with the correct label on the marking machine.

There are two throw-off conveyors in the system. One is for starch or finish work and the other for family-work.

Labor-saving devices used by the laundry include equipment for correct counting, listing, marking and washroom classifying of bundle, flat, rough-dry, and finished work. No. 8 National power marking machines, No. 3 National Lang counting and list-printing machines, and No. 1 Rose label tape and patch sewing machines are used. Speed and accuracy are essential for the turning out of satisfactory work on time.

Each of the fourteen booths is really a private office. The workers are separated, thus preventing confusion and the annoyance of talking and "visiting" among employees. When the operator is in the booth she can handle the work with the fewest number of movements, with but one handling of each piece, and with no crossover of hands slowing up the work in process.

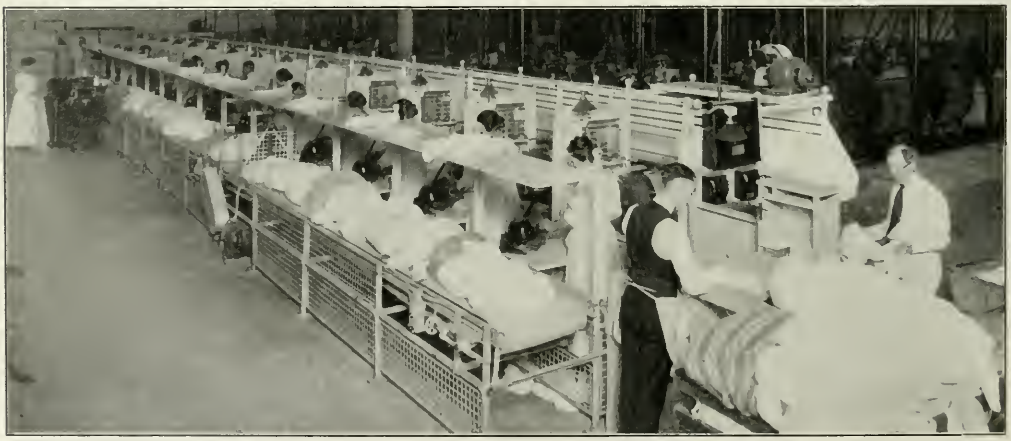


FIG. 1 SORTING AND MARKING ROOM OF A LAUNDRY EMPLOYING MECHANICAL EQUIPMENT

Selling the Automobile Overseas

How General Motors' Export Business Is Handled

By J. D. MOONEY

Vice-President, General Motors Corporation, in Charge of Export

> "In the first three months of this year the cars and trucks manufactured or sold overseas by General Motors numbered over 17,000, valued at approximately $13,500,000."[1]

THE work of the Export Organization of the General Motors Corporation is to sell all the products of the various factories which form the corporation to all the countries of the world outside of the United States and Canada.[2] The product to be sold comes from six major car divisions, and 23 accessory and parts factories. The car divisions consist of the Cadillac, Buick, Chevrolet, Oakland, Oldsmobile, and GMC Truck. The 23 factories in the parts group manufacture such well-known products as Delco and Remy ignition systems, Hyatt and New Departure bearings, Klaxon horns, Jaxon rims, etc.

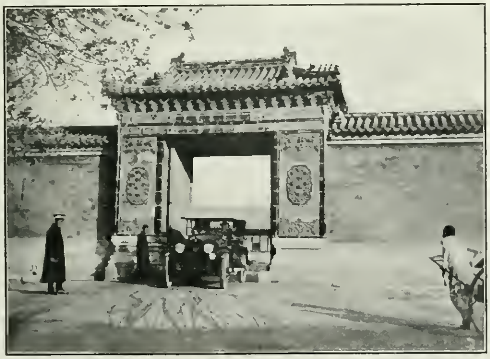


FIG. 1. A CADILLAC ENTERS THE WINTER PALACE IN PEKIN

The selling of all the products of so many different factories includes not only the usual problems incidental to a selling organization, but also problems of crating, shipping, assembling, and financing which vary considerably from such problems as they enter into sales for the domestic market.

The products from all these factories are sold through the export division to approximately 126 different countries. Figs. 1, 2, 3, 5, 6, 7 show cars in service in foreign lands. To sell the product of 30 different manufacturing plants to over 126 different countries is a complicated problem calling for far more research and study than a business in this country approximating an equal volume of sales. Before going further into the organization and the methods used in dealing with this market, we may mention some of the conditions which simplify the problem of serving the domestic trade and, in their absence, make the problem of serving the foreign trade so difficult. Fig. 4 shows an Export Functional Chart.

Index Number
658.9:629.113 Automobile industry.
Management
382 Exporting

For instance, in the domestic trade we have to deal with one nationality of people, speaking one language and having in general the same ideas, prejudices, and customs, and practically the same laws. In the domestic trade there is but one monetary system to deal with, one language, and one system of railways on which to ship our products. We have magazines and newspapers which cover the entire country, and it is possible to get our product before the public through these, in a way that cannot be approached in the overseas field. Also the home market has increased considerably because of the fact that in all parts of this country we have, or are building, good, hard roads designed especially for automobile traffic.

We have no laws in this country which interfere with the shipping of cars from one state to another, and no such thing as import duties between states to cause variation in price in the neighboring communities, and we have service stations throughout the country where any make of car can be repaired within a short time. All this seems only natural to us and nothing out of the ordinary. The conditions are largely the outgrowth of the widespread use to which the automobile is put in this country.

Some Special Difficulties of the Foreign Field

In Russia privately owned automobiles are prohibited, and in Bermuda all motor vehicles are forbidden. There is said, however, to be one automobile on the island. To comply with the law the engine has been removed and it is now drawn by a team of horses.

In a great many countries there are regulations specifying the number and locations of lights and type of drive. Many of these regulations compel a change from the standard American model.

Different import duties cause variation in the price, and sometimes there are regulations which prohibit or discourage the importation of some certain part of the car into that country, so that it is necessary to ship some parts of the car and build the remaining parts in the country before we can sell our products there. As an illustration of this last point, the import duty on automobile bodies into Australia is practically prohibitive, and few automobile bodies are shipped into Australia.

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[1] Quotation from *The New York Herald-Tribune*.

[2] This is the sixth of a series of articles on "Tuning-up General Motors". Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION for January 1924, p. 21; February 1924, p. 195; March 1924, p. 283; April 1924, p. 417; May 1924, p. 523; June 1924, p. 677.

There are a great many other factors entering into foreign sales which must be considered. These various countries are peopled by many different races. They vary in civilization from the head hunters in the South Sea to the highest civilization of Europe. In all these countries they have their own laws, prejudices, customs, methods of doing business and habits, all of which must be taken into consideration by those who wish to ship cars overseas.

FIG. 2 AN OAKLAND CAR PASSES A CAMEL CARAVAN IN A DESOLATE PART OF ASIA MINOR

Perhaps the variation between domestic and foreign sales and the necessity for an elastic viewpoint can be understood a little better if we use some one export function as an illustration. Consider the advertising activities and all the complications arising when you extend your sales to foreign fields.

In the domestic field the advertising director makes his appeal to people who use the same language and have the same customs and ideals. To such people he can plan a broad advertising campaign that will be suitable for all. His reading matter and display ads, will be generally understood, and his photographs will have the same appeal everywhere, because as a people we have the same viewpoint, traditions, and habits.

In addition to all these above reports, which are received regularly, reports are also received from the various offices in the field showing local conditions and any items of interest which affect export sales.

These reports require considerable time for thorough analysis. Some part of these reports are conclusively informative as they stand, while other parts are of value only when compared to like data from other sources, or the same data for previous periods of time. After the vice-president has studied these they are turned over to his executive staff for analysis and also for the purpose of making such comparisons.

Control Chart Comparisons

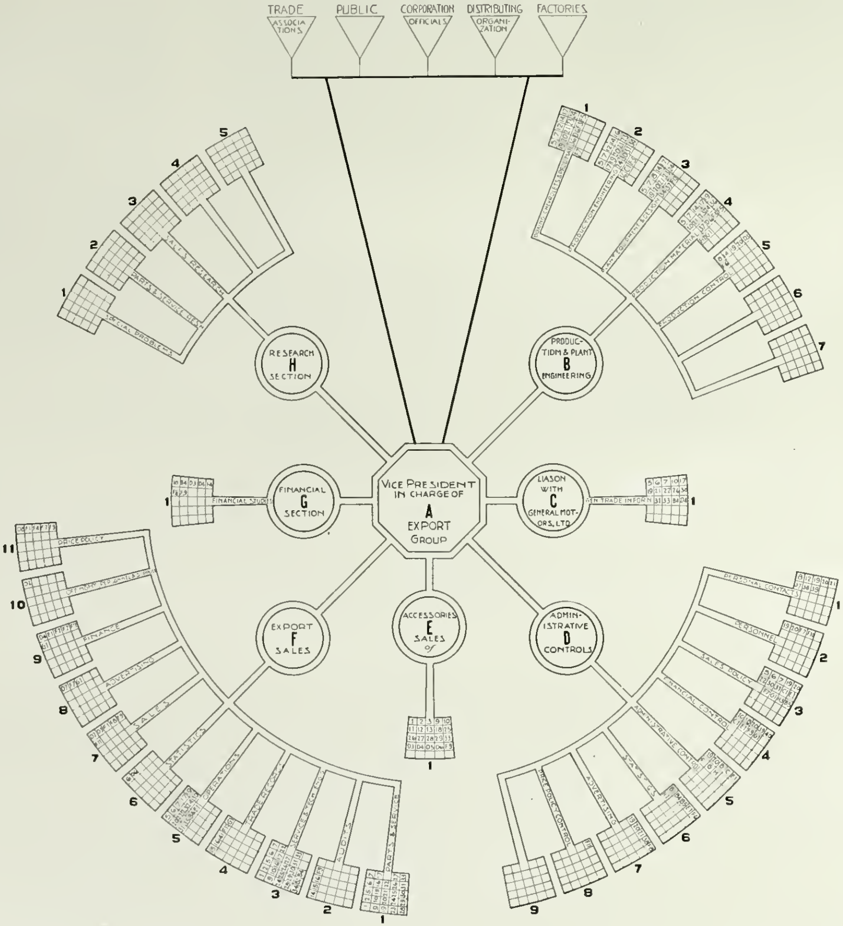
In analyzing these reports graphic control charts are used very extensively, being brought up to date each month. These charts are then studied very carefully to get a picture of the actual conditions existing and the trend of the business at the time the reports were made.

The first set of deductions shown is the relationships existing between the total production of all the automobile factories of the United States and Canada; the production of all the General Motors plants; the exports of all the United States factories and the exports of the General Motors units. These relationships are studied to determine our standing with reference to the business as a whole. If the General Motors units make a greater per cent of the total cars produced than they did in a previous period of time it is only reasonable to expect that our percentage of the export volume should also show an upward trend. Or, if the total automobile exports show an increase and our share of the total shows a decrease, then the logical conclusion is that the cause is local to our organization. Other sets of curves show the conditions existing within each of the corporations of the export group.

The total volume of sales each month is shown compared to the preceding months and also how these sales were divided among the various car lines. If one of our car lines happens to be exceptionally popular in any particular zone, there is always the tendency of the salesmen in that field to follow the line of least resistance and push this line to the exclusion of the others. Since our lines of cars are non-competitive as to price class, it is evident that if such a condition were allowed to continue the result would not be as favorable as if all the lines received their share of attention.

The standard measure by which it is decided whether each car line is receiving its share of export sales is the percentage which that car production bears to the

FIG. 3 A CHEVROLET SEDAN IN AN OLD-WORLD SETTING


TRADE ASSOCIATIONS
PUBLIC
CORPORATION OFFICIALS
DISTRIBUTING ORGANIZATION
FACTORIES
VICE PRESIDENT IN CHARGE OF A EXPORT GROUP
PRODUCTION & PLANT B ENGINEERING
LIASON WITH C GENERAL MOTORS, LTD
ADMINISTRATIVE D CONTROLS
ACCESSORIES E SALES of
EXPORT F SALES
FINANCIAL G SECTION
RESEARCH H SECTION
FINANCIAL STUDIES
GEN TRADE INFORM
PERSONAL CONTACTS
PERSONNEL
SALES POLICY
FINANCIAL CONTROL
ADMINISTRATIVE CONTROL
STATISTICS
ADVERTISING
PRICE POLICY CONTROL
PARTS & SERVICE
AUDITS
SERVICE & TECH ENG
TRADE RECORDS
OPERATIONS
STATISTICS
SALES
ADVERTISING
FINANCE
PRICE POLICY
SALES RESEARCH
PARTS & SERVICE RES
SPECIAL PROBLEMS
PRODUCTION ENGINEERING
PRODUCTION MATERIAL
PRODUCTION CONTROL
1
2
3
4
5
6
7
8
9
10
11

No	Name	Contacts
1	ACCESSORY Mfrs	E1 F3 F1
2	A C SPARK PLUG	E1 F3 F1
3	ADVERTIS'G AG'S	E1
1	BANKS	
5	BUICK MOTOR	B1 B2 B3 B4 C1 D3 F1 F3 F5
6	B F & D C	F4 F6
7	CADILLAC MOTOR	C1 F1 F3 F5 D3
8	CHEVROLET MOTOR	B1 B2 B3 B4 C1 D3 F1 F3 F5
9	COMPTROLLER GMC	B3 B5 D1 D3
10	D BROWN	D1 D4
11	BROWN-LIPE-CHAP	E1 F1 F3
12	DAY ENG LAB CO	C1 E1 F1 F3
13	FOREIGN ACCESS DISTRIBUTION	E1
14	FOREIGN AUTO DISTRIBUTORS	B1 D1 E1
15	FIELD PROD MEN GM EXP CO	B1 B2 B3 B4 B5 F2
16	FIELD SALESMEN GM EXP CO	F1 F2 F4
17	FIELD SERVICE GM EXP CO	F1 F2 F3 F4
18	FOREIGN AUTO SHOWS	E1
19	FISHER BODY	B1 B2 B3 B4 C1 F1 F3 F5
20	G M A.C.	D1 E1 G1
21	G M LTD	B1 B2 B3 B4 B5 C1 D1 D2 D3 D4 D5 D7 F1 F5
22	GM INT. A/S	B1 B2 B3 B4 B5 D1 D2 D3 D4 D5 D7 F1 F5
23	GEN MOTORS of CANADA, LTD	B1 B2 B3 B4 C1 D1 D7 F1
24	GMC TRUCKS	C1 D3 F1 F3 F5
25	HAMPTON WATSON	B1 B2 B3 B4 F1 F3
26	HOLDENS BODY	B1 B2 B3 B4 F1 F3 F5
27	HARRISON RAD'R	E1 F1 F3
28	E L HAYFORD	D4
29	HYATT ROLLER BEARING CO	C1 E1 F1 F3
30	JAXON STEEL	E1 F1 F3
31	KLAXON CO	E1 F1 F3
32	NEW DEPARTURE MFG CO	E1 F1 F3
33	OAKLAND	C1 D3 F1 F3 F5
34	OLDS MOTOR	C1 D3 F1 F3 F5
35	RAILROADS	
36	REMY ELEC.	C1 E1 F1 F3
37	PLANT EQUIPMENT MANUF RS	B2 B3 F1 F3
38	STEAMSHIP LINES	F5
39	SAURAS PROD MATERIAL	B1 B4
40		
41	A H SWAYNE	D1 D7
42	TREAS GMC	B3 B4 D1

FIG. 4 EXPORT FUNCTIONAL CHART SHOWING THE FUNCTIONAL DIVISIONS OF THE EXPORT ORGANIZATION ACTIVITIES AND THE INTER-DIVISIONAL CONTACTS BETWEEN THE INDIVIDUALS PERFORMING THOSE FUNCTIONS

total production of the corporation. This is an arbitrarily assumed standard which has been taken for want of anything better to begin with. As time goes on and our experience covers a more extended period of time, other factors enter which cause us gradually to modify our standards with which we started. An example of such a factor is the establishment of Chevrolet assembly plants in London and Copenhagen. These plants enable us to ship the cars as parts at a reduction in shipping costs and import duties.

Other sets of charts show the turnover and the percentages of profit and return on investment for the different corporations, as well as the relations between sales and the number of people on the pay-rolls. The analysis of these items is very little different from the customary methods applied to corporations here at home, although, of course, local conditions affect these to some extent. What these percentages should normally be has been determined very largely by experience and are not so apt to be relative to some other factor as is the case with some of the other controls.

All these control curves and charts are watched carefully for a sudden break in the wrong direction. When the break in any of the curves is sharp and is considered of sufficient importance, one of the executive staff may be assigned to make a complete study and to determine means of remedying the weakness. Sometimes the cause may be found by an examination of some of the other curves which show the trend of the many individual factors. In other cases the problem may be much more difficult and may even call for a trip to some distant market to make a critical analysis of conditions there. In such a case that portion of the work regularly performed by him, as defined on the functional chart, is turned over to some other member of the staff and he goes as far as necessary to locate and remedy the trouble.

History of the Export Business

The youth of the automobile business, as a whole, and the export section in particular necessarily limits the background by which many decisions are made and causes a more or less shifting set of standards by which the progress of the work is measured. In 1909 the total export trade of all the automobile factories of the United States only amounted to about 7 million dollars, and at the end of 1913 had only risen to something like 25 million. Then the total rose rapidly, due largely to the World War, to 120 million in 1916 and to nearly 300 million in 1920. Then the depression felt here in 1921 was prevalent throughout the world and was reflected in the total automobile export of the year, which was only about 82 millions for all the automobile factories of the United States and Canada. In 1922, this rose a little to slightly less than 100 million, and during the past year mounted to over 220 million.

This seems to indicate that our export experience, which only extends over a period of 15 years, is of less value as a background for use in judging the future than would ordinarily be the case. The first five years show us little, as the volume of sales during this period was too small in comparison to present sales. The next eight years are of less value because they were influenced by the World War and are not indicative of conditions as they exist today. Only the curves of the last few years seem to show a return to normal conditions, and although they have not remained steady over a long enough period to be sure, the indications at present seem to point very definitely to a period of increasing prosperity throughout the world.

The sales and service of the accessories manufactured by subsidiaries of the General Motors Corporation are sold abroad through the Overseas Motor Service Corporation.

Outside the United States, Canada, and the British Isles (except the sale of Chevrolets in Scandinavia and Northern Europe), all overseas sales of General Motors Cars and Trucks are made through a Corporation known as the General Motors Export Company. The work of this Corporation is divided into six sales divisions: The European, African, Australasian, Far Eastern, South American, and Caribbean. It maintains offices in 16 different cities and has distributors in 126 different countries. These offices and the zones which they take care of are as follows:

Fig. 5 A GMC Truck Starting Up El Bordo Road—One of the Oldest Mining Highways in Mexico

EUROPEAN SALES DIVISION
Paris Office
Holland, France, Belgium, Switzerland, Sardinia, Corsica, Malta, and Italy.
Madrid Office
Spain, Canary Islands, Portugal, Azores, Madeira, Balearic Islands, Tunis, Algeria, Spanish Morocco, French Morocco, Gibraltar, and Tripoli.
Constantinople Office
Jugo-Slavia, Bulgaria, Roumania, Greece, Syria, Turkey in Asia, Turkey in Europe, South European Russia, Palestine, Egypt, Anglo Egyptian Sudan, Arabia, Crete, and Cyprus.
Copenhagen Office
Iceland, Norway, Sweden, Denmark, Northern European Russia, Finland, Poland, Esthonia, Latvia, Lithuania, Germany, Austria, Hungary, Czecho-Slovakia.
AFRICAN SALES DIVISION
Johannesburg Office
Union of South Africa, Rhodesia, Bechuanaland, Bechuanaland Protectorate, Nyasaland, Portuguese East Africa, Angola, Southwest Africa, Belgian Congo, Tanganyika Territory, Kenya Colony, Uganda Protectorate, Madagascar, Mauritius, Reunion, Zanzibar and adjacent islands in Indian Ocean off East Coast of Africa, Rio de Oro, Mauritania (Fr. W. Africa), Senegal, Portuguese Guinea,- French Guinea,

Liberia, Ivory Coast, Dahomey, Cameroons, Spanish Guinea, Gabon (Fr. Equat. Africa), Gabinda, French West Africa, Upper Sudan, Cape Verde Islands, and other islands off west coast of Africa in South Atlantic Ocean.

AUSTRALASIAN SALES DIVISION
Sydney Office
New South Wales, Queensland, Northern Territory, British New Guinea, Solomon Islands, New Hebrides, Loyalty Islands, New Caledonia, Guam.
Melbourne Office
Victoria, South Australia, Western Australia, Tasmania.
Wellington Office
New Zealand, Fiji, Samoa, Friendly Islands, Society Islands, Tahiti, Cook Islands, Santa Cruz Islands.

FAR EASTERN SALES DIVISION
Shanghai Office
Japan, China, Korea, Formosa, Manchuria, Siberia.
Manila Office
Philippine Islands, Hongkong, French Indo-China.
Soerabaia Office
Borneo, Dutch East Indies, Federated Malay States, Siam, Straits Settlements, Celebes, Dutch New Guinea.
Calcutta Office
United Provinces Inc. Delhi, Bihar, Orissa, Bengal, Assam, Burma, Mysore, Travancore, Madras, Central India East of Jhansi.
Bombay Office
Aden, Mesopotamia, Persia, Afghanistan, Baluchistan, Punjab (exclusive of Delhi), Bombay, Central Provinces, Hyderabad, Rajputana, Kashmir, Ceylon, Central India West of Jhansi, N. W. Frontier Provinces, British Somaliland, Italian Somaliland, French Somaliland, Eritrea, Abyssinia.

FIG. 6 THIS BUICK MAKES REGULAR TRIPS BETWEEN KALGAN AND URGA, A DISTANCE OF ABOUT 628 MILES EACH WAY OVER THE GOBI DESERT, WITH A LOAD OF ABOUT 3300 LB.

SOUTH AMERICAN SALES DIVISION
Buenos Aires Office
Argentina, Chile, Paraguay, Uruguay, Falkland Islands, Peru, Bolivia, and Ecuador.
Sao Paulo Office
Brazil.

CARIBBEAN SALES DIVISION
Bermuda, British Guiana, Virgin Islands, Colombia, Costa Rica, Newfoundland, Nicaragua, St. Kitts, St. Vincent, Honduras, British Honduras, Bahama Islands, Barbados, Granada, Guatemala, Dominica B. W. I., Haiti, French Guiana, Dutch Guiana, Antigua, Cuba, French West Indies (Guadeloupe) Martinique), Dominican Republic, Panama, Trinidad, Curacao, Leeward Islands, St. Lucia, Jamaica, Salvador, Venezuela, Porto Rico.
Honolulu Office
Hawaiian Islands.
Mexico City Office
Mexico.

The administrative control of all the export activities is made especially difficult due to the fact that there are so many varying factors due to changing conditions throughout the world at large. An idea as to how these functions are handled within the office will be obtained from a study of the accompanying chart showing the line of contact on the various matters within the export organization. The vice-president in charge of export has a personal staff of assistants as shown on the chart, who handle the varying functions, some of which are permanent and others of which, such as studies of the progress of various lines or conditions, are only temporary. By means of this chart it is possible to turn the work over to another when occasion calls the one who has been doing this work to another part of the world to make an investigation or special study. It also enables people coming from one of the organizations to locate with comparative ease the person having authority over functions with which they may come into contact.

The actual control is by means of a number of reports which are sent to the vice-president from the various corporations under his direction. Each of these corporations sends a complete monthly report showing assets, liabilities, reserves, income, sales inventories, etc., as well as a detailed sheet showing analysis of profits, turnover, and return on investment.

From other sources within the corporation are received other reports showing total production for the month of the different car lines and the percentage which goes to the various export organizations. Then, from the Department of Commerce at Washington are received monthly statements of the total automobile exports divided into commercial and passenger cars, and divided also into the various countries to which these automobiles are sent.

As soon, however, as he begins to plan an advertising campaign for the foreign markets his troubles are upon him. The reading matter has to be translated into every modern language and then it is not suitable for use in many of the countries in which the appeal is to be made. Ideas of propriety vary a great deal, and a wording, which may be exactly suited to domestic trade, when translated, may be considered not only "common" but actually offensive. There are many subjects, which are topics of ordinary conversation in some countries, which are not mentioned in polite society here at home. Vice versa we have some mannerisms and methods of approach which, if they did not actually offend, would make our efforts ineffective in many countries where the people are, in some respects, far more sensitive than we are.

Then consider the difficulties the advertising director encounters in making up a display "ad" suitable for universal use. In this country where the newspapers are of a fairly uniform size and printed in a common language the preparation of such a display is simple compared to making one for the entire world. In many countries the daily paper is a little affair resembling the fiction supplement in one of our Sunday papers, and it does not readily lend itself to the average American display "ad," even if reduced in size.

In some countries there is no equivalent for the American daily paper, and in others the form is so different that it is almost impossible to translate the American "ad" so that it can be used. A display might be the masterpiece of a genius, exceptionally effective in the American papers, and yet be of very little value if reproduced upside-down and back-side-to on the rice roll of an Oriental *Tribune*.

An interesting side-light on this is found in China, where the medium of advertising is limited to the daily or weekly press, as there are no magazines such as we have in *The Saturday Evening Post* or *The Literary Digest*. In that country they have a peculiar reverence for the "chop" which is somewhat similar to, although not always exactly the same as, our "trademark." The Chinese man who has learned to trust a certain "chop" calls for his merchandise by that "chop" name, whether is be automobiles or piece goods, and all the arguments of a silver-tongued salesman go for nothing when he attempts to substitute goods of the unknown "chop". The moral of this from a publicity point of view is that the only part of the advertising that is really vital is the "chop" mark.

Then, there is another method of approach which is being used more every day in advertising, and which is very effective. That is the use of the photograph. At first thought the photograph would seem to be the universal medium of advertising, but there are reasons why the picture must be varied to make the desired appeal in the different countries and among different races.

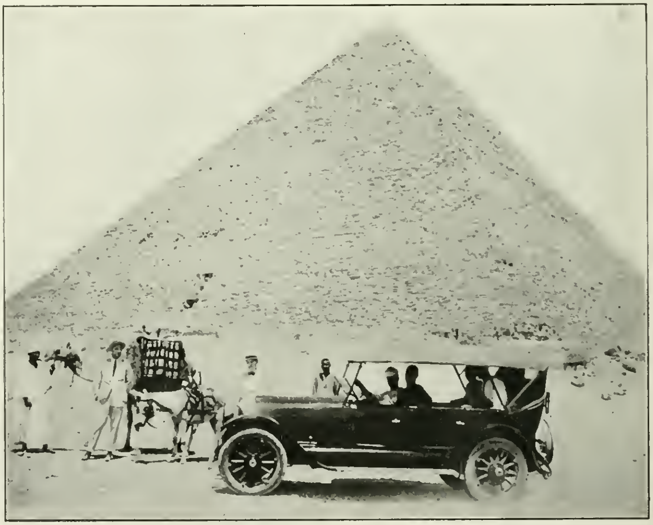


FIG. 7 AN OLDSMOBILE BEFORE THE GREAT PYRAMID IN EGYPT

Pictures for American Advertising

Here in America the favorite picture in automobile advertising is the one that appeals to the love of the beautiful, a beautiful car with a beautiful background and a beautiful woman in it. It may be a cheap car, but you never get that impression from the picture. You retain a composite impression of beauty from the combination of background, car, and woman. But that picture which might be extremely effective with the American public, might backfire if used in some of the foreign fields. It would not have much of an appeal in those parts of the world where you cannot sell trucks because wives are cheaper and just as efficient.

And even in civilized countries the picture would sometimes fail to have the desired effect because of the variation of ideas as to what constitutes beauty. In those parts of the world where Fairbanks far outranks Ziegfeld as a connoisseur of feminine beauty, the picture of the slender American girl in a large roomy car would not be as effective as a picture of a woman who filled the back seat and bulged over the sides. And that is the kind of a picture you have to use, especially when your most highly respected competitor has a car which seems to have inherent in it the ability to emphasize that bulging effect.

Organization of the Export Division

All of the activities connected with the sale of cars overseas are under the direction of the vice-president in charge of export. He operates through four distinct corporations, each of which is under general managers who report directly to him. The export operations in England, Ireland, Scotland, and Wales are handled by the corporation known as the General Motors, Ltd., which operates a Chevrolet assembly plant in London and sells all the General Motors cars in the British Isles. It has a subsidiary company, a corporation called the General Motors of Ireland, Ltd., which handles the sales in Ireland.

There is also a Chevrolet assembly plant in Copenhagen run by the General Motors International A/S, which handles the sales and assembly of all Chevrolet cars for the Scandinavian countries, and Northern Europe. The other General Motors cars outside of the Chevrolet in this territory are, however, handled by the General Motors Export Company.

Securing Funds for Business Expansion

By ARTHUR M. LEINBACH

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Index Number
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332.6 Bonds and securities

FINANCING is regarded by many business men as a mysterious method of turning fixed assets into cash, the intricacies of the practice being known to only a privileged group of bankers and bond houses. Frequently this belief is in itself one of the chief reasons for the failure of an issue of $1,000,000 or less of securities. If the executive will first and foremost put aside the erroneous notion that there is anything mysterious or intricate about his errand of securing funds for the expansion of his corporation, then he will have met an important requirement of successful corporation financing.

Corporate financing today is a merchandising proposition. A corporate loan—be it in the form of either notes or bonds—is marketed like a commodity and is bought, sold, and traded in among the various owners of the loan from time to time. If the issue is of bonds, the bond firm is the wholesaler of the loan that the business man has for sale, and the procedure and the principles to follow are the ordinary principles which would be followed in arranging the distribution of any commodity through a wholesaler.

Approach the matter from the merchandising angle. The financial statements and other certified facts concerning the proposed bond issue are, in effect, the sample case which is shown to the bond firm. No competent business executive would allow his salesmen to go to valued customers with a soiled and damaged line of samples. Yet it is quite possible that, unappreciative of the fact that he is *selling a loan,* this same business man would present financial statements to the bond firm that are unsatisfactory in the form in which they are drawn up. The statements may not necessarily be faulty in that they show too small an amount of assets or earnings, but—as is frequently the case—because they are drawn up in incomplete form, and the absence of essential detail prejudices the buyer of the bond firm against the issue. Have a sample of your goods made up in the accepted fashion and then look for your most likely market.

Finding the Market

Finding the market is again a merchandising proposition. When a merchant or manufacturer has a supply of goods for sale he naturally confines his offerings to those buyers who are most likely to be in the market for his product. Should the salesman of a lumber concern confine his selling efforts to wholesale grocers, he would, in the absence of unusual conditions, be looking for work somewhere else in short order. Nevertheless, bankers and brokers will bear testimony from their own experience that some business men who have loans for sale do not use any greater discrimination in marketing their offerings.

As the average business man usually has a loan for sale only at infrequent intervals, he is not familiar with the various types of buyers. Consequently he is likely to become discouraged by successive failures in what he terms "arranging for the loan," unless he is fortunate enough to come upon an interested buyer early in the proceedings. A survey of the market would disclose the fact that there are three main types of buyers of corporate loans. They are the commercial banker, the note broker, and the bond underwriter. While, in the present article, we are considering the latter type primarily, let us note, in a general way, what the other buyers of loans require.

Bank Loans

The banker and the note broker, if the quality of the article offered for sale meets their requirements, are beyond doubt the best customers for corporate loans. Their requirements are more rigid than the bond firm, but the prices they will pay are higher—that is, they offer the accommodation at the lower cost. Business men are more familiar with the requirements of the commercial banker, or paper broker, than with the requirements of the investment firm. The commercial banker expects to be called upon for accommodations that are essentially of a temporary nature. He prefers to keep his assets, that is, his loans, as liquid as possible, and expects any necessary expenditure for fixed property of a corporation to be financed by long-term loans and not, through him, in the form of a bank loan. It is considered good banking practice to require that the amount of borrowing be reduced as steadily and quickly as the borrower is able to do so. The loan is made on the "faith and credit" of the borrower rather than on the value of the borrower's fixed assets. The commercial banker is emphatic in his inquiries as to the moral integrity and standing of his client in the eyes of his business associates. He wants to know for what purpose the money is desired and how and when the borrower intends to liquidate the obligation.

Bank loans are given without the security of physical assets more frequently than not. The banker is lending out money which has been placed in his custody and for which he is personally liable in the event of loss. A much quoted statement of an internationally known American banker to the effect that he "would rather accommodate a good borrower on poor security than a questionable borrower on good security" typifies the requirements of the commercial banker as a buyer of loans. These requirements, as is also the case with the requirements of the commercial paper broker and the investment banker, will be found to vary with the supply of available credit and the demand for accommodation at any given time.

The Note Broker

The commercial paper broker, as a buyer of loans, has a more highly specialized set of requirements than either the banker or the bond firm. With him, corporate finance is more of a merchandising proposition than with the banker, because he is both the buyer and the seller. His purchases are made not for his own account, but with the intention of reselling the commercial paper to banks and individuals on a margin of profit. He is prepared to handle a larger accommodation than the banker because he distributes the entire amount of paper which he has purchased among a number of bankers who are his customers. His offering of the commercial paper to the banker implies that he has carefully investigated the borrower and considers him worth the line of credit which has been extended. This implied recommendation involves a responsibility and causes his requirements to be exceptionally rigid.

Commercial paper houses have in their many years of experience a lower record of losses than any other class of financiers. The commercial paper broker is, therefore, welcomed by the buyer of commercial paper at the bank because he is known to investigate minutely the merchandise in transit or other physical security as well as the financial responsibility of the borrower whose loan he is buying and reselling. Commercial paper brokers usually accommodate clients who are able to stand their extremely rigid requirements at a lower cost than any other source of credit. As a class of buyers of loans, they pay the highest prices for the loans which a business man has for sale, but like every buyer who pays the top price, they expect and require an article of the highest quality.

The Bond House

Should the seller of a loan find that his article of sale does not meet the requirements of these two classes of buyers, he still has a large group of potential buyers represented in the bond underwriting firms. In the natural order of things, bond houses get, and expect to get, only those types of loans which are not suitable for banks or note brokers. Any offering of a loan that is typically a bank loan will immediately raise the question—"Why is not this loan gotten from the local bankers?" In addition to the fact that offerings of unsuitable articles of sale contradict the accepted principles of salesmanship, it is more costly to finance a concern through the sale of an issue of bonds than to secure a bank loan. The corporate loan which is most suitable for underwriting might be described in a general way as a loan issued to finance permanent improvements, or the acquisition of new property, or a loan for other corporate purposes which could not be paid off promptly within a few years at most without impairing the cash position of the corporation.

Bond houses do not buy loans—which in this case are represented by bonds—for their own account, therefore they will restrict their purchases to loans which they believe are salable to the investor. The larger bond houses have a special department to do the buying. This department—or an individual in the case of a smaller firm—by frequent consultation with the sales department keeps himself intimately familiar with the likes and dislikes of the firm's customers. The buying motives of the customers are carefully studied and preference will be given by the buying department to loans which most completely appeal to these motives. When the seller of a loan feels prompted to protest that some of the provisions insisted upon are bothersome, he should take into account that these provisions are insisted upon to make the loan salable. The seller of a loan may perhaps feel that more consideration should be given to the excellent reputation for ability and honesty enjoyed by the officers of his concern—the borrowing corporation—in the trade or in the district where the corporation operates. If so he should take into account that although the buyer of the bond firm may himself be very much impressed with the personal qualifications of these officers, he knows from past experience that the ultimate purchaser—that is, the investor—is likely to be unaware of the high local repute of the management of the borrowing corporation. Of course, if the corporation should be fortunate enough to include among its directorate men who are known throughout the country for their business ability and moral integrity, the investor, and consequently the bond firm, will be favorably influenced toward the bond because of this fact.

After weighing in his own judgment whether or not the proposed loan will appeal to the investor, the buyer for the bond firm will then satisfy himself of the intrinsic merits of the loan from the facts submitted by the seller and from his independent investigation. Every investment house appreciates that in the very act of offering an issue of securities for sale it puts an implied recommendation and stamp of approval on the loan. The next facts that the buyer will consider—quite probably in the order mentioned—are: first, the line of business in which the corporation is engaged; second, the size of the issue; third, the security of the issue; and fourth, whether the issue can be sold quickly or whether it is a "slow-moving piece of business". As these facts, in the main, will influence the buyer, it is suggested that the seller of a loan compare his issue in these respects and eliminate all firms which would not be likely buyers because they do not handle securities that compare with the proposed loan in one or all of these four aspects.

Specialization Among Bond Houses

Most bond houses specialize in the underwriting of securities of concerns engaged in a certain line of business. The clients of the bond house frequently have been responsible for this specialization. The so-called railroad bond firm will, however, occasionally underwrite industrials or public utilities, and the same variation in practice is followed by public utility bond firms and industrial bond firms.

These different houses have drawn to themselves the class of buyers who prefer the type of bond in which they specialize, or they have "educated" their customers to the fine points of the kind of securities which they handle. Consequently their sales department encounters less sales resistance in this type of issue and the issue is marketed more quickly and hence more profitably.

Specialization has become marked among bond houses and particularly in the field of industrial securities; certain bond firms handle issues of one line of industry, such as the tobacco industry, the oil industry, or the textile industry, in preference to the securities of any other type of industry. The buying department of such a bond firm keeps itself well informed about business conditions in the line of industry in which the firm specializes, and the buying department members familiarize themselves with the important trade facts that tend to influence the value of the securities of this line of business. The buyer, therefore, will be apt to be more appreciative of the intrinsic merits of a proposed loan of the industry in which he specializes than another buyer would be who is not so familiar with the peculiarities of the business.

Size of Bond Issue

The size of the corporate loan also determines the bond house to which it should be offered. Each bond firm has a definite capacity of distribution with which the buyer of the bond firm is familiar. A considerable portion of the merchandising expenses, such as advertising, investigation, circularization, deliveries, and sometimes salesmen's commissions run no higher for a $1,000,000 issue than for a $500,000 issue. The preference of the buyer, as to size, will therefore be a loan which is as near to the fixed distribution of the firm as possible. The selling expenses of the smaller loan would be higher per thousand-dollar bond, and the price paid to the corporation which is raising the money would be fixed accordingly. Everything else considered, the borrower will get the best price by selecting a house with the amount of distribution required for his loan.

The security of the issue also influences the buyer of the bond house. He wants to know immediately whether it is a secured bond, debenture, preferred or common stock. Most bond firms limit their dealings entirely to bonds, although a number of firms include among their bonds a few high-grade investment preferred or common stocks. In point of fact, many stocks offer a more conservative investment than many bonds, and it is the element of risk involved in the security rather than the name, that fixes the type of issue which the house will buy. However, the most favorable terms can ordinarily be obtained for a bond issue from a firm which specializes in bonds, and for a stock, especially a common stock, from a firm which specializes in stocks.

The rate of return to the investor is a point to consider in marketing a loan. The rate of return to the investor is a requirement that is not as rigid, within limits, as the other requirements mentioned above. That is to say, any given house will probably underwrite securities which yield from 5½ to 7 per cent to the investor under present conditions of the market. The more conservative issues—and it follows that the larger degree of safety will sell at the lower yield—have a broader market in that they are suitable investments for banks, insurance companies, and wealthy investors who buy in large blocks. The medium grade issues, or the class of securities known as a good "business man's risk" are usually sold in smaller blocks to individuals and are not suitable for institutions. Consequently the first type of issue will move more quickly and can be underwritten with a smaller margin of profit to the bond house, whereas the high yield securities are ordinarily considered as slow-moving issues and require a large margin of profit to the underwriter. A house which is accustomed to dealing in the slow-moving, high yield issues will have a different character of sales methods, equipment, and personnel from the house which deals in quick-moving, readily marketable issues. The former firm would not be likely to pay as high a price for a quick-moving issue as the latter firm would, and the latter would not be likely to consider the purchase of a slow-moving issue at any price.

Frequently a borrower will come into the market with an inaccurate conception of the salability of his proposed loan and will not readily concede that the proffered price is equitable to both parties concerned. It is the business of the buyer of the bond firm to judge the salability of the proposed loan, and it is the exception rather than the rule when his judgment is at fault. Conditions in the bond business change from one period to the next and the experience of a borrower several years ago is no criterion of conditions at any other stated period. Incidentally, during the past 5 years or more and including the present, it is generally recognized that the bond market is a "buyers' market" and the costs involved in the sale of an issue are considerably higher than the cost 10 years ago.

Finding the Right Bond House

The financing officer of the corporation seeking a loan may spare himself exhaustive research for a suitable bond house by making use of one of these several aids. Newspapers and financial magazines publish daily the offerings that are made by bond houses and summarize the various offerings made throughout the week. Investors' services and the publishers of the several security manuals include in their service a brief description of all the offerings made over a period of three months or for the year. While these compilations are intended primarily for the investor, they will, equally well, serve the corporation which intends to sell an issue of securities by showing which types of securities are being handled by each bond house.

Any bond house will mail, upon request, their current list of offerings. This list should, however, be used by the seller of the proposed loan only as a guide and not as a conclusive summary of the buying requirements of the house in question. This is so, because many of the issues included on the offering sheet for investors are not actually underwritten by the bond firm, but perhaps represent a small block of securities purchased at a discount from another firm that actually underwrote the issue.

The fact that it is so difficult for a busy executive to become familiar with the requirements of the market for loans has led to the establishment of firms and individuals in Wall Street and in the money centers of our other larger cities whose business it is to place issues of securities with the proper selling concern. Their knowledge of the market and the peculiar wants of each individual firm enable them to sell the loan at a higher price and in less time than the seller himself is usually able to do. They are well versed in the practical side of underwriting and put the issue in the most salable shape possible, eliminating all of the undesirable features as far as the buyer of the bond firm is concerned, and arranging for the inclusion of technical provisions in the indenture of the issue which would tend to strengthen the weak points. Some of the smaller distributing houses, not having the necessary facilities for buying new loans, depend almost entirely upon these so-called "wholesale dealers" for the securities they sell. With their practical experience in the bond business, it follows that these wholesale dealers have ready access to the private office of the officer of the bond house who has charge of the buying of loans. The commission or "overwriting" of these dealers is usually warranted by the services they render a business man inexperienced in placing his issue.

Adapting the Loan to Meet Requirements

Fortunately a loan is quite an elastic article of sale, so that within obvious limits, it can be modified to suit the wants of the buyer. When one or several bond firms are selected, as possible buyers of the issue, it is expedient for the bond seller to outline tentatively the form in which the issue will be sold. That is to say, the buyer of the loan will want to have enough particulars in the first interview to decide, subject to his own investigation, whether or not he might be interested in purchasing the proposed issue. He cannot decide, of course, when the seller of the loan has no more definite conception of the loan than that he "wants $750,000 for the expansion of his business;" that the fixed assets of the concern are worth substantially in excess of the proposed financing; that the interest is earned on a comfortable margin and that he is "open to any reasonable proposition". Unless the buyer is extremely anxious to secure a piece of business for the sales department to work on immediately, he is likely to give a negative answer to such an offering.

Presentation Requirements

The seller of the loan should offer the bond buyer he wants to interest a comprehensive and detailed statement of earnings, covering five previous years or more, and a detailed balance sheet. More consideration will be given to a statement that is prepared and certified to by an independent accountant who is known to financial houses to be accurate and conservative. The buyer wants to know in the first interview how the issue is secured—if it is a secured loan—what coupon rate the security will bear, what sinking fund provisions are intended, a statement of how the proposed financing will affect the affairs of the corporation, and a tentative idea of the price at which it can be purchased by the underwriter. Each individual issue, of course, will call up other points, and, in all probability, such inquiries will be made early in the negotiations, if the buyer is at all interested.

At this point of the negotiations, the usual merchandising principles involved in the sale of commodities cannot be used without modification. For instance, it appears to be an open question with business men arranging a loan, whether or not the weak points of the loan should be emphasized or even mentioned. To those with a great deal of practical experience in arranging loans, there is no doubt on this point. If the loan is obviously not a bona fide proposition, the investment banker is the wrong man to attempt to place it with, and if the loan is a bona fide proposition, it is always to the advantage of the borrower to discuss any weak points quite freely with the man who is intending to underwrite it. Nine times out of ten, any unmentioned weak points will come out with later investigation, and it hurts the deal to have such points disclosed at that stage of the game. In the one time out of ten that such facts are not disclosed by the investigation of the bond house, the weak point will become evident when the loan is offered in a definite form to the investing public. If such points should be of a nature seriously to impair the intrinsic merits of the issue, they will be reflected in the market price after the security is sold. The facts made known when the security was originally offered for public investment being sponsored by the highest executive officer of the borrowing corporation, this situation reflects upon him personally. The net result is that the corporation of issue goes on public record as having impaired credit.

Caveat Emptor

These points are brought up here not because it is common practice for borrowing corporations to misrepresent the status of the proposed financing, but because frequently the weak points of any particular piece of financing, which are perhaps known only to the executive arranging the loan, are not emphasized in the negotiations with the underwriting firm. The adage "let the buyer beware" has no place in the practice of corporate finance, because financing is built primarily on confidence. Ordinarily, the underwriter, through purely technical provisions in the indenture is able to safeguard his clients against any existing points of weakness in the loan, and to do so without making the loan more costly on the part of the borrowing corporation. A great many instances could be quoted of securities now outstanding among public investors where the borrowing corporation is grateful for the inclusion of these technical provisions because they have upheld the market level of their outstanding securities. Examples might also be quoted of loans that never reached the underwriting stage because some of the unfavorable points were not disclosed in the early part of the negotiations, although these points might have been strengthened adequately in the final draft of the indenture of the loan, so as to make the issue readily marketable.

The cost of financing may be reduced to a minimum by offering every possible provision for the safeguard of the investor in the indenture of the loan. Shoes are bought for either style, comfort, or serviceability, or perhaps all of these qualities. A high price will be paid for the particular brand of shoe which is certain to give these qualities. Bonds are bought for income, present and prospective. A high price will be paid for any particular bond which is certain to give this income. The element of uncertainty is called the "factor of risk" in the case of the investment, and actually represents the factor of risk in the purchase of a pair of shoes.

When an investor pays $100 for a $6 annual income he is paying a considerably higher price than would be represented in the purchase of an 8 per cent security at $100. In order to get the same return—$8 per year—on the former type of issue, he would have to invest over $133 at 6 per cent to get the $8 per year income available from the latter. The amount of yearly income for each hundred dollars invested determines the cost price of the loan to the buyer and not the fixed rate of return, nor the quoted price of any fixed denomination. A low yield represents a high price and a high price will give a low yield on any security with a fixed rate of interest.

The above explanation of price is given because borrowers are apt to deceive themselves into believing that they have arranged "cheap accommodation" because they secure a price close to the par value of the securities sold. The underwriter, on the other hand, may be able to sell the issue at retail at a premium over the par value because a high coupon rate still allows for a fair price to the investor on the yield basis. Moreover, the borrowing corporation is apt to be unappreciative of the higher comparative price of the loan that results from the decision of the underwriter to sell at 6½ per cent coupon bond instead of a 7 per cent coupon rate, which was the rate originally intended by the borrower.

The Machinery of Selling

Another caution which might be touched upon is the tendency of some borrowing corporations to refuse to modify their tentative plans for financing and to bargain with the buyer concerning the underwriting price. Were corporation loans advertised for sale to the highest bidder, as municipal loans are sold, then such rigidity of purpose might be more in keeping with things. Sellers of loans who attempt to drive hard bargains are frequently inclined toward the theory that "If Smith and Company won't buy the loan, some other company will".

This theory is more likely to be true in selling a commodity than in selling a loan. The system of distribution of bonds is more flexible and intricate than the system of distributing commodities. Many of the underwriting houses sell only a small portion of the loan to their own clients and organize a syndicate or selling group for the distribution of the larger portion. Even on an issue of securities involving less than $1,000,000, a thousand dealers in the same city and other cities may be invited to join the underwriting house in distributing the loan. While the buying is being negotiated, tentative deals may be in progress with other firms and an inquiry will be passed along to these houses concerning the issue under consideration, although the name of the corporation of issue will not be mentioned until negotiations with the borrowing corporation are fully consummated. In this way it becomes known that a certain type of issue is being negotiated in some quarter of the financial district. When a loan is thought to be "shopped around" by the seller, its chances of being underwritten decrease greatly. For this reason it is not expedient to negotiate with several underwriters at the same time with the aim of selling to the buyer who offers the highest price.

Securities are frequently said to be "sold before they are bought," that is to say, allotments are arranged with other dealers as soon as the underwriting firm has a "firm offering" or an option on the proposed loan. All sales of new securities are made "when, as, and if issued," and the definite certificates for the securities are prepared after an interval of several months. In view of the complex system of distributing securities, as outlined above, it is evident that promiscuously giving options on the loan to any one who appears to be a possible buyer is not good financing practice to be followed in any instance.

Planning the Loan

In preparing a tentative form for a proposed financing, the borrower should acquaint himself with the general principles of corporate finance. Actual practice may tend to vary with the accepted theories because conditions are changing constantly, both in business practice and financing requirements. As mentioned previously, the peculiarities of the investing public, taken as a whole, fix the requirements for successful underwriting, and during the past several years the mood of the investing public has been subject to noticeable changes. Consequently there has been a tendency to drift away from the principles of corporate finance as understood in the past.

As an indication of this it may be noted that an increasingly large amount of dividend paying stock is held by small investors not interested in the affairs of the corporation beyond dividends on the stock. Stocks have come up to an investment plane, wherever the likelihood of a continuance of dividends is indicated. Therefore, sometimes a stock issue is as attractive to the investing public as a bond issue and the corporation seeking a loan may find it to advantage to raise the funds required by means of a stock issue.

The business world, as is generally recognized, is susceptible to wide swings from prosperity into depression and back from depression into prosperity. These swings affect the earning power of practically all corporations, in the sense that they have a theoretical maximum earning power under favorable conditions and a minimum earning power under unfavorable conditions. As the value of the corporate assets is based on their earning power more frequently than their sale value, the value of the assets varies with the change in earning power.

In theory, the fixed liability, i. e., the funded debt, of a corporation should correspond to the minimum earning and asset value while the difference between the minimum and maximum should be taken up by the common stock which has no fixed interest charge. The junior securities, therefore, depend upon the good or bad fortune of the corporation for the rate of income which they pay. During the past several years, however, a number of so-called semi-speculative bond issues have been sold to the public, and paid a higher rate of interest than is ordinarily paid on bonds, because they did not represent capitalization of the lowest possible value of assets or the least amount of earning power under adverse conditions. This, and the presence of common stocks, which correspond closely to the lowest value, tend to disturb the former division between stocks and bonds.

The issuance of fixed obligations, the interest on which could hardly be earned in a future period of adversity and the principal of which would exceed the value of the corporate assets under the same conditions, is a tendency which is viewed with alarm by old-line financiers. They claim that such bonds do not represent the best far-sighted policy for the corporation of issue, nor do they serve the best interests of the investor. A corporation which issues bonds on the basis of present prosperity and not on the basis of minimum asset value or earning power is distinctly capitalized for prosperity. Such corporations are capitalizing the equity created through the increased dollar value of their physical assets at a time when the value of the dollar is low and the asset value in dollars is correspondingly high. The presumption is that business will always be good and that the dollar will always have its present value—a presumption which is not borne out by economic experience.

A Wheel Puller for Automotive Equipment

Index Number
658.583 Wheel puller

THE universal wheel puller shown in Fig. 1 will be of interest to all men concerned with the operation or repair of trucks in a manufacturing plant. The puller is made for ordinary use, but especially to remove wheels from motor-car axles when they have become wedged or rusted fast and usual means would result in injury.

By providing a secure grip on the hub and a stout screw through which to apply the power, the device enables the most stubborn wheel to be pulled off without damage. The puller is applicable to all ordinary sizes and styles of wheel. It works equally well on those of wood, wire, or disc construction, and can be used on passenger cars as well as on trucks for industrial purposes. Since the pull is exerted around the hub no strain is brought to bear on the spokes or rim.

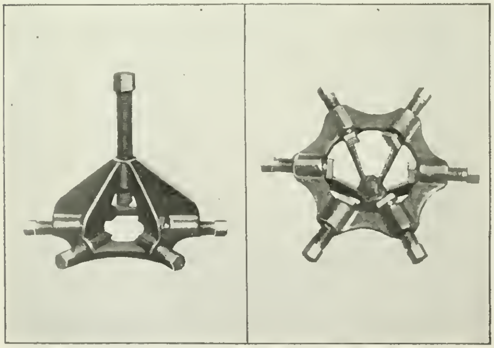


FIG. 1 SIDE AND BOTTOM VIEWS OF THE UNIVERSAL WHEEL PULLER

The body of the device is a single casting. In this are mounted the six screws which clamp on the hub of the wheel. Each screw, or dog, has a pivot end on which is swiveled a gripper. The latter engages with the threads on the hub of the wheel, but not in a manner to cut or jam them. Injury is prevented by making the ratio of threads on the gripper suited to fit any number of threads on the wheel hub. Any size of hub up to and including 4½ in. in diameter can be spanned by the device.

In the center of the casting, and at right angles to the grippers, is located the screw which applies the pull. It can be operated by any type of wrench. A socket wrench on a crank handle is the most convenient form to use where much repair work is done.

Fig. 2 shows the method of attaching the puller to the wheel, which is done by an ordinary wrench. The grippers cover a large portion of the hub circumference. When they are firmly clamped in place the power screw is run up against the axle. Further pulling up on this screw exerts a powerful pull on the wheel around the entire hub and the wheel is forced off against the resistance of a tight fit or rust.

The universal wheel puller was developed by S. Kimmerle as a time and labor saving device.

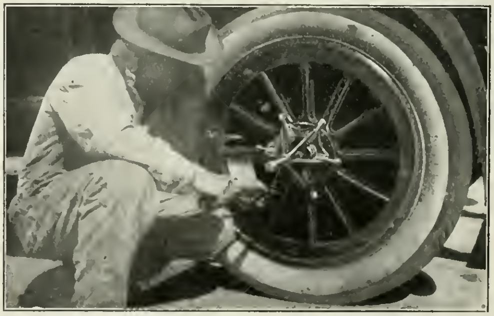


FIG. 2 METHOD OF ATTACHING THE PULLER TO THE HUB OF THE WHEEL

Organization of Maintenance Division

Planning Its Duties for Economy of Operation

By FREDERICK A. WALDRON

Consulting Engineer

LET us assume that a new factory with a new product, new tools, machinery, and other equipment is started and that we have installed in full operation the engineering, production, inspection, and accounting divisions.[1]

For a certain length of time everything will move along smoothly, but troubles develop slowly that are outside the province of any of the other divisions, such as: The necessity for heat as the weather becomes colder, and artificial light as the days become darker and shorter; accumulation of scrap and rubbish; failure of motors or other machinery to operate; tightening of belts; repairs to steam-piping, plumbing, electric light wires, and buildings; and various other matters incidental to maintaining proper conditions under which the divisions before enumerated can constantly and efficiently function.

The development of the above needs requires a new branch or division of the factory organization, which reaches a most important stage when the materials making up the plant begin to wear out. In original conception, these needs were taken care of by the master mechanic or "millwright" to whom all troubles relating to plant and equipment were promptly referred. With the development of large manufacturing units and the introduction of expensive machinery and large investments, it has been found necessary to establish a maintenance division which has control in a general way of items enumerated in Fig. 1.

Index Number
658.58 Shop Maintenance

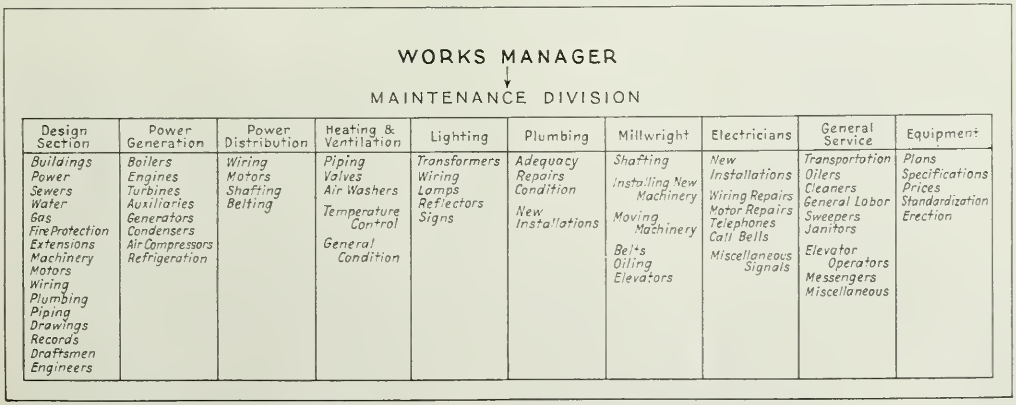
Different organizations have given this division different names, but practically the same functions. A few of these names commonly used to identify it are as follows:

1. Plant division.
2. Power and plant division.
3. Engineer of works division.
4. Superintendent of buildings division.
5. Master mechanic's division.
6. Motive-power and fixtures division.
7. Maintenance division, etc.

The term maintenance division adequately covers all of the above items and therefore we have adopted the term in this type of organization for its breadth of meaning, also its brevity.

In small productive units the maintenance division can be consolidated with the inspection, production, or engineering divisions. It should be specifically understood, however, that the functions of these divisions should not be sacrificed or neglected where the necessity develops for such consolidation. Where large amounts of capital are invested in plant and machinery the maintenance division should be a separate division with a chief who is responsible directly to the manager of the works, and of equal rank with chiefs of other divisions.

This man should be an engineer of broad experience in factory management, equipment, and construction, with executive ability, and must possess more than the average good judgment, as there is no place where



WORKS MANAGER
↓
MAINTENANCE DIVISION

Design Section	Power Generation	Power Distribution	Heating & Ventilation	Lighting	Plumbing	Millwright	Electricians	General Service	Equipment
Buildings Power Sewers Water Gas Fire Protection Extensions Machinery Motors Wiring Plumbing Piping Drawings Records Draftsmen Engineers	Boilers Engines Turbines Auxiliaries Generators Condensers Air Compressors Refrigeration	Wiring Motors Shafting Belting	Piping Valves Air Washers Temperature Control General Condition	Transformers Wiring Lamps Reflectors Signs	Adequacy Repairs Condition New Installations	Shafting Installing New Machinery Moving Machinery Belts Oiling Elevators	New Installations Wiring Repairs Motor Repairs Telephones Call Bells Miscellaneous Signals	Transportation Oilers Cleaners General Labor Sweepers Janitors Elevator Operators Messengers Miscellaneous	Plans Specifications Prices Standardization Erection

FIG. 1 ORGANIZATION CHART SHOWING CONTROL OF MAINTENANCE DIVISION

good judgment will produce greater economies than in the handling of the maintenance division. One or more capable understudies or assistants should be selected so that at all times the operating functions of the plant are presided over by one who can step in and take full control of emergency problems.

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[1] See MANAGEMENT AND ADMINISTRATION, January 1924, p. 39; February 1924, p. 173; March 1924, p. 295; and April 1924, p. 427; for articles by Mr. Waldron on the organization and work of these divisions.

Policy

The limitations of work to be performed by this division should be decided by the president or board of directors of the company. The economy of the maintenance departments going into the design and construction of buildings, or the installations of power plants is debatable. Many concerns provide for this work in their maintenance departments. The majority, however, are inclined to have new buildings designed by engineers making a specialty of this class of work.

The power plant comes under the same category. After an experience with both methods, it is the judgment of the writer that it is more economical to have an outside firm of engineers design and supervise the construction of buildings and the installation of power plant equipment.

General Organization of Division

This division should in a measure be organized on the five piers, namely: engineering; production; inspection; accounting; and its own maintenance. It is considered good practice to do this in view of the fact that the character of work and the most economical method of performing this work differ to such an extent from specialized production that the details of organization should be arranged to suit the necessities that are thus developed.

The engineering section of the maintenance division should have its chief draftsman, special designers, and general utility engineers and draftsman for such work as may be required by plant enlargement, machinery changes, equipment changes, power plant design and changes, and the various other elements which may from time to time be required.

The production section of this division includes all groups that are utilized in doing the work prepared by the engineering section. These are generally classified as follows:

1. Millwright's section.
2. Plumbing section.
3. Electrician's section.
4. Motive-power section.
5. Piping section.
6. General service section.
7. Fire protection section.
8. Contractors.

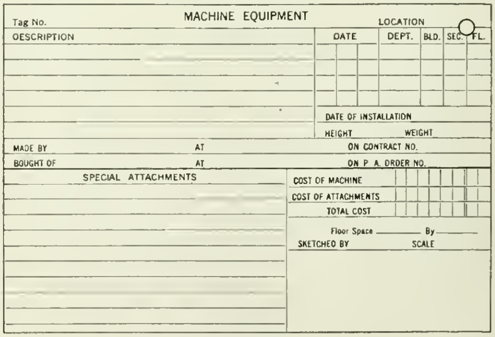
The inspection section should constitute a force of sufficient size properly to look after the work of the producing section as well as routine and current inspection of plant equipment. This includes periodical inspection of the line shafting, belting, motors, fire protection, piping, boilers, power generators, general order and neatness, condition of buildings, lighting, sanitary fixtures, safety appliances, etc., and other similar items.

The clerical section cares for the details of timekeeping, follow-ups, costs, appropriations, progress charts, etc.

The maintenance section of this division should see that all the apparatus, or other facilities required to do the work of the entire division, are kept in proper order.

The above description does not mean that a small factory requires all of the sections presided over by different individuals. A separate individual should be placed in charge of these sections only at such times as the volume of work makes it economical to do so.

If the functions of these sections can be carried in the heads of the individuals who are responsible, without impairing the efficiency of the plant as a whole, this method is undoubtedly the most economical solution of the problem. It is common practice in many places at the present time. In some places, it has proved most economical, and in other places it is most extravagant. The loss of output in the latter case is more than enough to warrant the expense of additional help to maintain the plant continuously in operating condition in all matters which directly affect the annual output.



MACHINE EQUIPMENT
Tag No.
LOCATION
DESCRIPTION
DATE
DEPT.
BLD.
SEC.
FL.
DATE OF INSTALLATION
HEIGHT
WEIGHT
MADE BY
AT
ON CONTRACT NO.
BOUGHT OF
AT
ON P A. ORDER NO.
SPECIAL ATTACHMENTS
COST OF MACHINE
COST OF ATTACHMENTS
TOTAL COST
Floor Space ______ By ______
SKETCHED BY
SCALE

FIG. 2 FORM OF MACHINE TOOL RECORD

The items outlined in Fig. 1 are suggested headings and may be enlarged upon as the exigencies of each individual case may require.

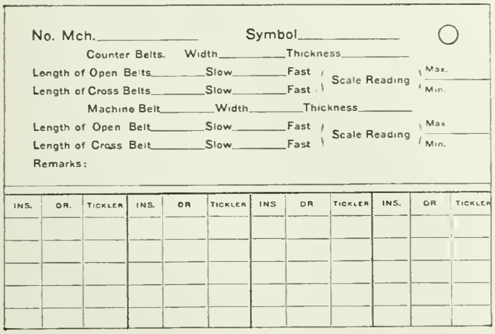
Equipment

Where the business conditions warrant, it is oftentimes desirable to place the drawing up of specifications, inquiry as to price, and tabulation of bids for all new equipment purchased, under the control of the maintenance division. The person having this entire matter in charge is generally designated as the equipment engineer. It is his duty to keep a full and complete record of existing equipment and prepare all necessary data for the purchase of new equipment. Upon the completion of this data, it is to be turned over to the purchasing department for execution of final contracts and purchase records. A form of machine tool record is shown in Fig. 2.

The engineering staff of the maintenance division should, in general, consist of a construction engineer, electrical engineer, and one or two good all-around mechanical engineers. If the work and scope of these divisions are limited, these engineering functions can be handled quite efficiently by one man.

Fire Protection

It is unnecessary to take up space in this article describing or outlining the details incident to the operation and organization of the fire protection section of the maintenance division when complete literature is available in the form of small booklets covering building construction, fire protection equipment, electrical equipment, sprinklers, pumps, special hazards, maintenance and care, mill fire brigade organization, and other miscellaneous items.[2]



No. Mch.______ Symbol______ ○

Counter Belts. Width______Thickness______

Length of Open Belts______Slow______Fast } Scale Reading { Max.

Length of Cross Belts______Slow______Fast } Scale Reading { Min.

Machine Belt______Width______Thickness______

Length of Open Belt______Slow______Fast } Scale Reading { Max

Length of Cross Belt______Slow______Fast } Scale Reading { Min.

Remarks:

INS.	OR.	TICKLER	INS.	OR	TICKLER	INS	OR	TICKLER	INS.	OR	TICKLER

FIG. 3 BELT RECORD CARD FOR MILLWRIGHTS' SECTION

Millwrights

The millwrights' section has full charge of motive power and fixtures exclusive of the power plant and electric motors. The items, in general, are as outlined in Fig. 1.

Record and care of all belts are among the duties listed. This work involves painstaking, systematic, and scientific methods to give a belt maximum life, to replace or repair it when necessary, and to avoid shut down from slippage, breakage, or running off the pulley. This work can best be managed by the Taylor-Barth methods which are substantially as follows:

1. Making standard specifications for all belts.
2. Establishing standard dimensions for all widths and thicknesses of belt.
3. Recording location and length of every belt in the plant.
4. The use of the Barth belt bench and scales for making up belts.
5. Cementing belts.
6. Keeping duplicate belts on hand.
7. Proper dressing of belts.
8. Proper design of countershafts.
9. Guarding of belts on main line or jack-shafts.
10. Reclaiming of belts soaked with oil or other foreign substances.

This work can be facilitated by the use of systematic forms and ticklers with properly arranged memoranda. Fig. 3 shows a belt record card and Fig. 4 a tickler card.

The adoption of motor-driven machinery has in many cases reduced the number of belts in a factory to a minimum, but there are many factories today where belting does, and probably will for years, form the major element of power transmission.

Electrical Section

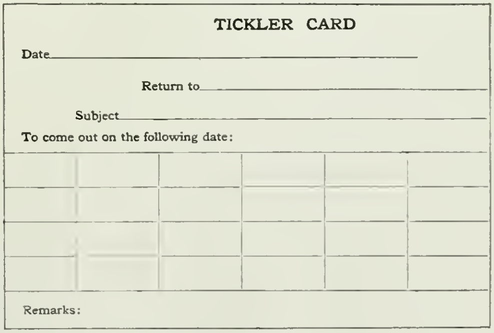
The electrical section has been developed to a very important phase of the maintenance department in the last 15 years. It is now essential in all but small-size factories to have a department which has full control and care of the generator and motor installations, also the light and power wiring. It is the first duty of this section to see that new work is installed in accordance with the insurance rules, and that the apparatus furnished is the best obtainable for the duty which it is to perform.

The current work of this section, after the new apparatus has been installed, for convenience is divided into two classes, as follows:

Class A. External repairs, such as contact cleaning, switch adjustments, fuse replacements, wiring changes, and upkeep, and guarding against overloading of motors and transmission wires.

Class B. This includes what might be called internal repairs, requiring trained help capable of rewinding armatures, building commutators, repairing brush holders, and replacing "frozen" or worn out bearings.

It is not advisable to establish a group for this work unless there is a sufficient amount of repairs to keep it reasonably busy. In most cases it is better to have a few duplicate motors for emergency and have the repairs made by the manufacturer from whom the machinery was purchased. The disadvantage of the latter method is the delay involved by shipment and the time required for the repair and return of the motor. Oftentimes, the loss in production more than offsets the cost



TICKLER CARD

Date______

Return to______

Subject______

To come out on the following date:

Remarks:

FIG 4 FORM OF TICKLER CARD

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[2] See Bulletins 1 to 57, inclusive, of the Associated Factory Mutual Fire Insurance Company.

of a repair crew even though they are not kept fully employed on work of this kind.

Construction Section

The construction section should be headed by a construction engineer of experience and should cover all questions involving structural safety and operation, as well as all engineering calculations as to safety and economy of new work and contemplated changes of existing conditions. All drawings for the entire plant as well as records of location of every important feature should be kept by this section. A few of these are:

1. Property maps.
2. Underground piping maps.
3. All factory piping, including steam for heat and power, water (hot and cold), fire equipment (sprinklers, hydrants, and play pipes), and the location of fire extinguishers.
4. Design and construction of new buildings.
5. Design and construction of power plant.
6. Layout of transportation facilities and related details.

The maintenance division in its organization can include more diversified factors than any of the other four piers of an industry.[3] It is therefore very essential that the utmost care and judgment should be used in determining the scope of its activities, bearing in mind that every item added to the "work list" of the maintenance division involves a direct expense and an increase in overhead.

This expense may be divided into three classifications as follows:

1. All expense necessary for upkeep and repairs.
2. Expense of insurance against accident, breakdowns, and conflagrations.
3. Any direct expense which would furnish desirable but not absolutely necessary items.

Another important factor is: How far it is policy to work out the details incident to new work, or enlargements, in this division? If the building operations and plant additions are of a magnitude to keep the working force of engineers and draftsmen constantly employed, economic results necessarily follow. If, on the other hand, these operations take place spasmodically, it is far cheaper to pay the usual engineering fees for this work to some outside concern. The *per diem* cost is higher, but the total cost will probably be much lower, and the routine of the regular organization is not interfered with in any way.

The organization which has been outlined is intended to cover every phase of work done by the maintenance division. Modifications, by expanding or contracting these duties, are possible and will oftentimes be found necessary. However, the outline gives a basis on which the works manager can establish this division and develop its functions.

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[3] The five piers are: engineering; production; inspection; maintenance; and accounting.

Electric Trucks Prove Economical in Operation

Index Number
658.281 Industrial trucks

THE Pacific Bone, Coal and Fertilizing Company has large quantities of bone, in bulk and sacked, and raw and finished fertilizer products to handle. The bulk bone is received frequently in ship loads, which necessitates storage. It is generally in a partially broken or crushed condition and can be handled by a fork or shovel.

Due to the constant increase of business, and desire to lower costs, the company has dispensed with the old way of handling this material, which was in small, two-wheel dump trucks, carrying from 300 to 350 lb., and wheeled by one man from the place of storage to grinders. In place of the hand method an electric industrial truck with a 36 cu. ft. dump body, as shown in Fig. 1, is now used. This truck can be operated at about four times the speed of a man using a two-wheel dump truck, and will hold 1250 lb. of crushed bone. As a result one man with an electric truck will handle as much as 6 to 8 men by hand. A Chinese laborer drives the truck.

The company ships and distributes practically all of its product in sacks, and a large volume of sacked material is moved from point to point in process. For this purpose an elevating platform truck of 4000 lb. capacity is used. This truck, with a dozen or more platforms, holding from 20 to 25 sacks at a time, is able to handle from four to six times as much sacked material during the day as could be moved under the old hand trucking method. The advantage is especially evident when material must be moved 200 or 300 ft. or farther from storage to shipping point.

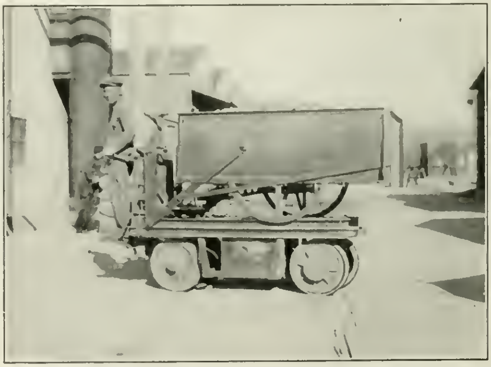

FIG. 1 ELECTRIC TRUCK WITH CHINESE OPERATOR

Maintenance of Plant Equipment

By W. L. HITT

General Foreman, Maintenance Department, Westinghouse Electric and Manufacturing Company

Index Number
658.2 Plant maintenance

IN a general sense, plant equipment includes buildings with their sprinkler, service water, and sewerage lines; gas, oil, high-pressure steam, and air lines; heating lines, both hot-air and steam; machine tools with their drives; cranes, traveling and jib; broad and narrow gage transportation lines with their rights of way; and power and light lines with their numerous branches.

At the East Pittsburgh plant of the Westinghouse Electric and Manufacturing Company, the maintenance of plant equipment has three distinct divisions: the machine repair department, supervising repairs to machine tools, cranes, broad gage locomotives, and locomotive cranes; the power-house, with supervision over high- and low-pressure steam lines, heating system, gas and high-pressure air lines, and the drinking water system; and the maintenance department, responsible for other work and co-operating with the power-house and machine repair departments in repair work which becomes necessary throughout the plant.

Organization of Maintenance Department

A study of the organization of the maintenance department will give a better understanding of the methods employed in attacking the problems arising in this particular work.

The superintendent is responsible to the works manager for all repairs. Reporting to him is a general foreman of maintenance, who in turn has foremen and their assistants of sections under his direct supervision. These sections comprise most of the building trades and also a general foreman of wiring and lamp repair, who has his foremen and assistants. In addition to repair work, this department takes care of all new work except that let out by contract. The organization chart, Fig. 1, shows, graphically, the complete organization reporting to the superintendent.

In the maintenance of buildings, the repair of roofs and skylights comes under one group, and that of floors, doors, and windows under another, both of which are controlled by the carpenter foreman and a group of assistants and workmen.

There are approximately 2,570,000 sq. ft. of roof on the plant, of which an area of 419,000 sq. ft. is taken up by skylights. From 10 to 15 men work continually on the roofs, cleaning and repairing gutters, replacing broken slate, sealing cracks in skylights, and attending to such other work as may be necessary. Experience has shown that slates with an exposure of less than 6 x 10 in. develop leaks as they age, so that the slate roofs are gradually being replaced with gravel roofing, which has proved very satisfactory. During the last 7 years, 341,632 sq. ft. of roof of wood purlins and $1\frac{1}{4}$ in. sheeting construction has been replaced with steel purlins and concrete slabs covered with gravel roofing, making an ideal fire-proof roof which is not affected by weather conditions.

The men in the group working on the roofs of the plant report to the office for instructions during rains and are dispatched immediately to any place where a leak occurs. The basis of the success of this system is the co-operation of the various foremen of the works' departments in reporting conditions needing repair.

The Westinghouse plant contains 4,078,000 sq. ft. of floor space. The major portion of the ground floor is paved with asphalt paving blocks, 3 x 5 x 12 in., but in some places concrete, vitrified paving brick, and wood paving block have been used. The wood block has been found most satisfactory, for it stands up well under practically all conditions and requires no repairs. The asphalt blocks make a good floor but have a tendency to crumble when subjected to oil, and in several instances have been replaced with vitrified brick. When a floor must be repaired, the foreman of the works department places a request with the general foreman who, in case of extensive repairs, refers the matter to the

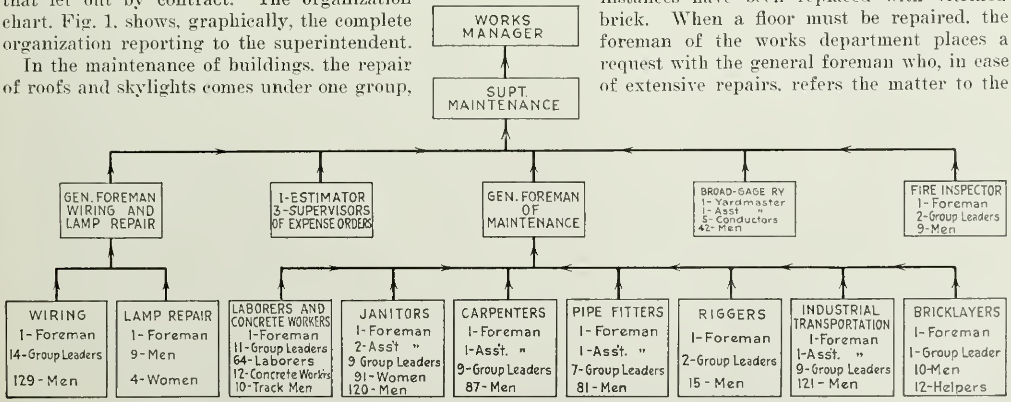
WORKS MANAGER
SUPT. MAINTENANCE
GEN. FOREMAN WIRING AND LAMP REPAIR
1-ESTIMATOR 3-SUPERVISORS OF EXPENSE ORDERS
GEN. FOREMAN OF MAINTENANCE
BROAD-GAGE RY 1-Yardmaster 1-Asst " 5-Conductors 42-Men
FIRE INSPECTOR 1-Foreman 2-Group Leaders 9-Men
WIRING 1-Foreman 14-Group Leaders 129-Men
LAMP REPAIR 1-Foreman 9-Men 4-Women
LABORERS AND CONCRETE WORKERS 1-Foreman 11-Group Leaders 64-Laborers 12-Concrete Workrs 10-Track Men
JANITORS 1-Foreman 2-Ass't " 9 Group Leaders 91-Women 120-Men
CARPENTERS 1-Foreman 1-Ass't. " 9-Group Leaders 87-Men
PIPE FITTERS 1-Foreman 1-Ass't. " 7-Group Leaders 81-Men
RIGGERS 1-Foreman 2-Group Leaders 15-Men
INDUSTRIAL TRANSPORTATION 1-Foreman 1-Ass't. " 9-Group Leaders 121-Men
BRICKLAYERS 1-Foreman 1-Group Leader 10-Men 12-Helpers

FIG. 1 ORGANIZATION CHART OF MAINTENANCE DEPARTMENT

superintendent for decision. After an investigation, the work to be done is handled by the bricklayer foreman.

Practically all floors except the ground floor are of laminated, long leaf, yellow pine, 2 x 8 x 10 in., covered with five quarter tongue and groove maple flooring. There are spans of 14, 16, and 20 ft., 16 ft. predominating. The maintenance of these floors is under the supervision of the carpenter foreman. Periodic inspections are made to detect the existence of dry rot, but in very few cases has it been necessary to replace the joists, even after 20 years of service. The flooring in the aisles is laid diagonally with respect to the direction of the traffic and is independent of the main flooring. These two factors are conducive to longer life and ease of replacement. Depending on the severity of the traffic, the aisles are replaced every 8 to 12 years.

Doors and Windows

When doors or windows in the plant must be repaired, reports come in from various sources, either from the foreman concerned or from the inspectors for the power-house, who are most vitally concerned with proper heating and ventilating conditions. These reports are given prompt attention and the repairs made by the department of maintenance. The cost of repairs to doors has been considerably lessened by the replacement of double-acting doors with light sliding batten doors on barn door hinges. The greatest maintenance expense incurred is in connection with the fire doors, for these are necessarily heavy and with their automatic closing devices prove to be a source of trouble. It requires the attention of one man continually to keep the fire doors in good operating condition.

The cleaning of windows and skylights comes under the direction of the janitor foreman who supervises a group leader and 8 window-washers. It is his responsibility to see that the windows are kept clean and that skylights are cleaned once a year. The incentive system of wage-payment has proved very satisfactory for this type of work. In most cases 608 lights of glass, 10 x 14 in. comprise a day's work, but this varies with the accessibility of the windows.

The skylights are cleaned during the summer months by four men working in pairs. A solution of oxalic acid, 25 lb. to 100 gal. of water, is used for this work. It is smeared over the glass with worn brooms, allowed to stand a short time and washed off with running water from the hose.

The maintenance of lavatory facilities is divided between the janitors and the plumbers. There are 125 lavatories of the major class, 92 for men and 33 for women. These are cared for by a force of 45 men and 29 women, each of whom is assigned one or more lavatories and is held responsible for their sanitary condition. It is their duty to report to their foreman any defect in plumbing; these reports are referred to the plumbers for immediate action. There is a plumber and helper assigned to each of the four areas into which the shop is divided.

All of the systems of steam and hot-air heat, high-pressure air, gas, oil, and drinking water are cared for by the power-house force. For this purpose the plant is divided into four areas, each of which is patrolled continually by a man whose duty it is to detect leaks in any of the systems.

The drinking water system is inspected daily by one man, who, in addition to cleaning out the basins, regulates the valves for proper flow of water. The oil system is inspected by one man during the day time only. Considerable trouble has been experienced by rusted out oil and benzine lines when they are laid under the surface in ash-filled ground. These lines, as they are replaced, are laid in terra cotta split conduit.

Whenever leaks occur in any of the systems the inspectors make a written report to their foreman, who enters a requisition for the necessary repairs by the pipefitters.

The maintenance of electric motors is under the supervision of the general foreman of wiring. In the East Pittsburgh plant there are approximately 5,500 motors, ranging in capacity from ½ to 200 hp. The organization for the care of these motors consists of 10 oilers and 7 trouble men, each of whom has a certain number of motors assigned to him. The oilers patrol their areas continually to insure proper lubrication of the motors and, in case of necessity, notify the trouble men who immediately make any required repairs. Each trouble man is required to telephone his office every hour for reports of motor trouble that may have occurred in his area. In case of emergency, the first man to telephone the office is dispatched to the source of the trouble whether it is in his area or not.

An average of 18 cases of serious motor trouble—requiring replacement of a stator or rotor—occur each month. Seventy-five per cent of these are direct current motors of less than 3 hp. that have burned out due to overloading. If the records show repeated breakdown of a motor, it is assumed that the motor is too small to drive its machine and, if the machine is found to be mechanically perfect, a request is sent to the works department for a motor of higher rating. For this purpose a stock of approximately 250 spare motors is kept on hand.

Cleaning Electric-Light Globes and Reflectors

One of the necessary problems of the maintenance department is that of cleaning the 28,000 electric-light globes and reflectors throughout the works. Two men are assigned to this work in the general offices and four in the shop. These men have a hand-truck equipped with removable holders for carrying about 100 clean reflectors. This truck is taken to a convenient place, the dirty shades are removed, replaced with clean ones, and the globes dusted off. When the supply of clean shades is exhausted the dirty ones are taken back and washed. Shades are changed in the general offices every two or three months, and in the executive offices every three or four weeks. As a result of their inaccessibility during the working hours, the lights in the shop are not cleaned more than once every six or eight months, depending on the dust content of the atmosphere. The men engaged in this work also make all necessary globe replacements, of which there are about 8,000 per month.

It is the duty of the maintenance department to detect and remedy all leakage of water from either the service or fire lines. At regular intervals, when the plant is practically shut down, meter readings are taken to determine the approximate leakage and whether or not repairs are necessary. When the meters show an appreciable amount of leakage, a more thorough search is made with a detectorphone to find the exact location of the leak. All fire hydrants, and sprinkler and hose riser drains are inspected daily by the fire inspectors, and leaks are repaired.

Upkeep of Fire Equipment

One of the most important responsibilities of the maintenance department is prevention of fire and upkeep of fire equipment. For carrying on this work the foreman of fire inspectors, who reports to the superintendent, has a force of 11 men, 8 on day turn and 3 on night turn. Each of these men is assigned a certain area which he patrols continually, inspecting all valves, sprinklers, and hose risers for proper setting, checking fire hose and fire buckets for location and condition, refilling any fire extinguishers that are empty, inspecting for fire hazards such as greasy rags and waste, and seeing that all safety boxes are in the proper condition. In addition to these duties, the fire inspectors must see that all fire doors are working properly and that hose reels, valves, hydrants, and fire exits are unobstructed. All fire hazards are immediately reported for removal or for equipment with the proper protection.

The plant is protected with the Gamewell Fire Alarm System. The shop and outlying buildings are divided into five zones and have in all 139 signal boxes, which are marked with a conspicuous red light.

All cans of benzine and other combustibles must conform to the specifications of the Fire Underwriters, but an additional safeguard is provided when these combustibles are kept inside the building. They are placed in an iron box with a lid held up by a weight and rope. In case of fire, the heat at 155 deg. fahr. fuses a link and allows the lid to fall, smothering the flames. All open oil tanks and varnish vats which cannot be protected when in use have sawdust piles nearby for smothering fires. When not in use they are covered with tight-fitting covers. Gum pots and spraying hoods are ventilated with fans which discharge into the open. A combustible deposit builds up, however, within the air-ducts and occasionally gets on fire. An open steam-jet in the air-duct extinguishes these flames quickly.

There are two organizations in the plant for fighting fire, the first of which, called the First Aid Fire Organization, is composed of 12 groups of 8 men each. Fire practice is held for these groups once a week, and in case of fire they answer calls in the area in which they work. The second fire organization is a regularly organized fire department of two captains and 30 men, all of whom are employees of the company. A dormitory is maintained for these men in a central location and a certain number are available at all times. Fire drills are held regularly and each man is carefully instructed in his specific duties.

The painting of buildings, either inside or outside, is under the supervision of the superintendent of the power division, but all painting is done upon the request of the maintenance department. Outside steel work in the plant is painted once every two to four years with a high-grade oil paint. For the inside walls or ceilings, the painting is usually done by sprayers. One gallon of paint will cover approximately 300 sq. ft. of surface when it is sprayed on, whereas it will cover about 400 sq. ft. when put on with a brush, but the saving in labor of the first method more than offsets the cost of the additional paint used.

The construction of line- and counter-shafts, the maintenance of which is part of the work of this department, consists of two 6 in. I-beams paralleled on 18¾ in. centers clamped to the lower member of the roof trusses or to the bottom flange of the floor beams, or, where neither is practicable, to brackets riveted to the column on 16 ft. centers. The shaft hangers are hung either above or below these beams with cast iron clamps. By this construction the whole unit becomes an integral part of the building itself and cannot be pulled out of line unless the building moves. All hangers are of the oil ring type with reservoirs holding about one quart of oil.

Although within the last 7 years many thousand feet of line shafting have been discarded and replaced by individual motor drive, there are 11,200 ft. of shafting still in operation, with about 1,800 countershafts.

Eleven oilers and one group leader in the maintenance department care for this shafting. Each man is assigned a certain area containing about 180 countershafts, and it is his duty to care for all counter- and line-shafting within his area, filling line-shaft bearings once every three months, oiling counter-shafts once every day, and keeping both line- and counter-shafting free from rust. All line-shafting is overhauled once every two years for the purpose of tightening loose bolts and renewing the oil.

Care of Belting

In addition to its many other duties the maintenance department is responsible for the care of all belting. There are 9 belt stations throughout the shop, each serving a certain area. One man is assigned to a belt station to take care of emergency cases and to report to a group leader any other cases that may need attention. Any work that cannot be handled at the belt station is taken to the belt department where it is given immediate attention. Old belts are salvaged by being split up into smaller sizes.

Most of the belting in use is oak-tanned leather from 1 in. single- to 92 in. double-ply in the shop, and up to 40 in. three-ply for test floors. Special chrome-tanned belting is used for heavy duty. All new belting is dressed in a heated mixture of sperm oil and tallow as soon as it is received.

The average life of overhead straight-pull belting is from four to six years, but in some instances belts have been operating continuously for 12 years. The greatest replacements are on the mule drive, spindle drill presses. The average life of these 1½ in. belts is about 30 days, and the consumption in the plant is approximately 2,000 ft. per month.

Useful Products Made from Waste Materials

By DR. HARRISON E. HOWE

THE study of waste in industry is one that invites careful attention because of the economies which it brings about. Many products of great commercial importance and value have been developed from materials formerly thrown away as useless. In some industries, in fact, by-products from this source return more profit than the original articles produced. In others, whole branches of manufacturing have grown up around the utilization of wastes.

To give an idea of what has been accomplished in a few major industries to realize profits from wastes, Table 1 has been prepared. The items mentioned cover a wide range of manufacturing and have been applied in a very large number of plants. The list may seem small in variety, but it represents millions of dollars of useful products annually.

Index Number
660.048 Products from Waste.

In the list of waste materials reclaimed, those from the chemical industry lead and number 10, which is natural because chemical treatment figures largely in reclamation processes. Wastes from food product industries total 9, and those from metal reduction 7. Natural products of field and forest furnish 6, the slaughtering industry, paper manufacture, and the gas and oil industry furnish 3 each. Woodworking and rubber supply 2 apiece. Others included in the table are from fabric, cement, metal and soap manufacturing and refuse collection sources.

Research activities have developed not only new materials from wastes, but also many additional uses for these materials, thus opening up profitable markets.

TABLE 1 WASTE MATERIALS AND RESULTING MANUFACTURED PRODUCTS

WASTE	PROCESS	PRODUCT	USE
Fabric	Mechanical and chemical	Felt	Prepared roofing
Paper	Mechanical and chemical	Cardboard Low-grade paper	Wrapping paper Cartons, boxes, etc.
Blast furnace slag	Mechanical and chemical	Cements	Hydraulic cements
Cement mill dust	Electrical precipitation		Return to process
Cement mill fumes	Electrical precipitation	Potash salts	Fertilizers Glass and soap
Smelter fumes	Electrical precipitation	Arsenic	Insecticides Fungicides
Bagasse	Mechanical and chemical	Paper	Field covering to control weeds
Bagasse	Mechanical and chemical	Paper	Insulating board
Molasses	Fermentation	Alcohol	Industrial and scientific uses
Molasses fermentation, waste	Calcination	Potash	Agriculture
Steffens' waste from beet sugar manufacture	Evaporation and calcination	Potash salts	Agriculture
Beet pulp	Drying	Stock feeds	Stock-raising
Sawdust	Chemical and fermentation	Alcohol	Industrial and scientific purposes
Waste wood	Mechanical and retorting	Charcoal Acetates	Industrial purposes Manufacture of acetic acid
		Methanol	
		Wood flour	Dynamite and linoleum
Cull citrus fruits	Chemical	Pectin Citric acid Lemon and orange oils	Jelly-making Soft drinks Food flavors
Fluorine	Chemical	Fluorides	Metal enamels
Fish scrap	Mechanical	Fertilizer Ingredient	Agriculture
Hoofs and horns	Chemical	Glue	Adhesives
Flaxseed	Mechanical	Floor-coverings	
Flax straw	Mechanical and chemical	Paper pulp	Paper Manufacture
Sulfate process waste liquor	Mechanical	Soda	Returned to sulfate process
		Fuel	Combustion
Sulfite process waste liquor	Mechanical	Alcohol	Industrial and scientific purposes
Used tires	Mechanical and chemical	Recovered rubber	In mechanical rubber products
Bones	Mechanical	Buttons Fertilizer Ornaments	Clothing manufacture Agriculture Decoration
Blood	Mechanical	Fertilizers	Agriculture
Tin cans	Electrochemical	Tin tetrachloride	Silk-weighting
Cheap metal punchings	Mechanical and refining	Various metals	Re-use
Corncobs Oat hulls	Chemical	Furfural	Synthetic resins
Waste garbage	Chemical and mechanical	Glycerin Greases and oils Fertilizer	Industrial purposes Industrial purposes Agriculture
Gasoline in natural gas	Chemical and mechanical	Casinghead gasoline	Motor fuel
Helium in natural gas	Mechanical and chemical	Helium	In dirigibles
Photographic fixing solutions	Chemical	Silver	Photographic and chemical solutions
Gases from beehive coke ovens	Mechanical and chemical	Coal-tar by-products	In synthetic organic chemicals
Heat	Waste heat boilers	Steam	Heat and power
Calcium chloride	Drying and crystallization		On highways
Cuttings from rubber industry	Mechanical and chemical	Roofing	Buildings
Cottonseed	Mechanical and chemical	Oil Stock feed Linters	Industrial uses Stock raising Paper and nitrocellulose products
Sulfurdioxide fumes from metals	Chemical	Sulfuric acid	Chemical and industrial purposes
Chlorine	Chemical	Bleaching powder	Finishing plants
Hydrogen	Chemical		Hydrogenating oils or nitrogen fixation
Ferric oxide from aniline oil manufacture	Chemical and mechanical		Red paint for iron
Press cake from linseed oil			Cattle feed
Low-grade smokeless powder	Chemical	Pyraline	Handles Ornaments, etc.
Lye liquors from soap manufacture	Chemical	Glycerin	Industrial uses
Pyroligneous acid from charcoal production	Chemical	Acetic acid Methanol Wood tar	Chemical and Industrial purposes
Waste paper	Chemical and mechanical	Papier mache Wall board	Ornaments Buildings
Copper refinery sludge	Chemical	Silver Gold	Jewelry manufacture
Acid waste from tin plate		Copperas	Red paint Ink
Iodine from nitric acid manufacture	Chemical	Iodine	In medicines
Sulfate pulp mill waste	Chemical	Turpentine	Industrial purpose
Chlorine from caustic soda industry	Chemical	Chloroform carbon disulfide	In anesthesia, manufacture of carbon tetrachloride
Selenium from copper refining	Chemical	Selenium	Glass manufacture Electrolytic cells

The Construction and Costs of Southern Cotton Mills and Equipment

The Piedmont Section of the Carolinas

By RALPH G. MACY

Consulting Mechanical and Electrical Engineer

THE manufacture of textiles is the largest and most important industry of the Piedmont Section.[1] and of the states of North and South Carolina in which this section is located. There are some 11.000.000 spindles in these states and approximately 692 mills. One-half of the people in the territory are connected in some way with this industry, which has had a remarkably rapid growth within the last decade, and has been responsible for much of the wealth in this section.

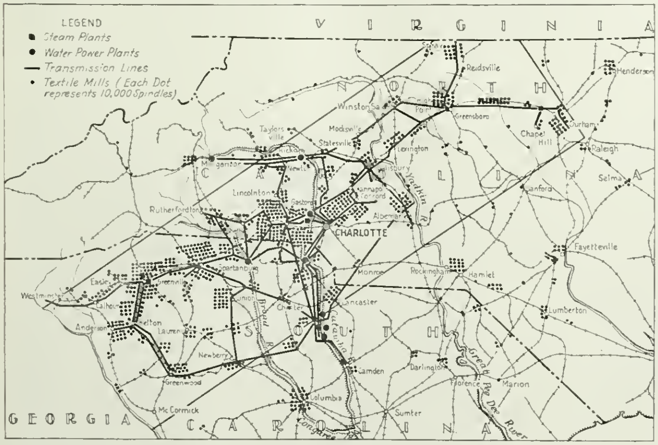
LEGEND
Steam Plants
Water Power Plants
Transmission Lines
Textile Mills (Each Dot represents 10,000 Spindles)
VIRGINIA
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
Reidsville
Henderson
Winston Sa
Greensboro
Durham
Chapel Hill
Raleigh
Mocksville
Statesville
Taylorsville
Lexington
Morganton
Newton
Selma
Sanford
Lincolnton
Gastonia
Kannapolis
Concord
Albemarle
Rutherfordton
CHARLOTTE
Yadkin R
Fayetteville
Spartanburg
Monroe
Rockingham
Hamlet
Easley
Greenville
Westminster
Calhoun
Union
Chester
Lancaster
Lumberton
Anderson
Belton
Laurens
Broad R
Catawba
Newberry
Camden
Darlington
Greenwood
Florence
Marion
Columbia
Great Pee Dee River
McCormick
Sumter
Congaree

FIG. 1 MAP SHOWING LOCATION OF SPINDLES IN NORTH AND SOUTH CAROLINA

In Table 1 are some figures which show the growth of this industry in North and South Carolina; and of the total spindles in these states 80 per cent are in the Piedmont section.

Fig. 1 shows the location of spindles in North and South Carolina and also shows the concentration of this industry in the Piedmont sections. In South Carolina there are some 183 mills with 5,175,100 spindles. These mills in some cases are huge in size, containing as high as 116,000 spindles in one building. The average number of spindles per mill, however, is roughly 28,000, and allowing 5 sq. ft. per spindle, this would require a floor area of 140,000 sq. ft. per mill.

In North Carolina there are some 509 mills containing 5,605,000 spindles, these mills being smaller in size and averaging 11,000 spindles per mill. A brief description of the construction of the old mills and the new, will show the advancement that has taken place within the last 20 years; and a description of the electric drive will also show the modernization of the textile industry in the Piedmont section.

Index Number
38(75) Industries in the South
658.2:677 Textile mills. Construction

The older mills are built of brick and are of slow-burning wall construction 3 stories high, with wooden beams and floors and with wooden or cast iron columns. The roofs are of tar and gravel, and the stairs and window frames are of wood. The window area is, in most cases, not over 50 per cent of the wall area, and the interior lighting consists of 50-watt lamps, without reflectors—the spacing being some 16 ft. on centers. The machines occupy approximately 75 per cent of the floor space, and the aisles 25 per cent—the older mills being laid out on a basis of 4½ sq. ft. per spindle. In Fig. 2 the brick building at the left was built in 1912 and was considered modern in every respect at that time. The reinforced concrete building at the right was erected in 1923, and shows the change in the type of construction that has taken place in 11 years. The fire protection equipment of the old mills has been modernized, due to the insurance requirements—the usual equipment consisting of a 1000-gallon fire-pump, steam-driven, and connected to a 100-hp., 1800 r. p. m. motor so connected that if power is shut off from the building the pump can be operated direct from the outside power-supply lines.

In a number of these old mills the power is supplied by rope drive from a steam-engine or water-wheel. This rope drive runs in a big drive well to the main pulley, which drives the entire line shafting of the mill. However, many of the mills are now being electrified and are using small group drive.

When these older mills were built the method of expansion was to add on a section at one end, and this accounts, in some instances, for the large number of spindles under one roof in these mills. Many were constructed about the year 1900, when the cost was some $20 per spindle. The cost, now, of $55 per spindle, would require an enormous outlay of capital to build a mill containing the spindlage of some of the older mills. Moreover, it has not been found advisable to construct these large mills for several reasons.

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[1] Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION for May 1924, p. 517; June 1924, p. 663.

Leaving out of consideration the tremendous investment required to build a mill of 100,000 spindles, it has not been found economical from a manufacturing standpoint. In the small mills production is better and more economical due to the increased facilities afforded for careful supervision by the superintendent, and the low cost of internal transportation of the material. The opinion in general with regard to the economical size of a textile mill manufacturing yarns of various sizes is shown in Table 2.

The modern mills are, in many respects, constructed differently from the old mills. They are usually built a certain length, depending on the floor space required, and a number of sections wide, usually two, the standard section being 26 ft. The height between floors is some 14 ft. and this increases a foot for each section added to the first two, the maximum being 6 sections, which would make a maximum height between floors of 18 ft. These mills are generally constructed 3 stories in height although this varies considerably depending on the nature of the product that is being manufactured.

The material used is reinforced concrete or brick with steel sash, and in some cases there are concrete pilasters with brick walls and steel sash. The floor system is mushroom type, flat slab construction, approximately 9 in. thick. On this is laid the mixture of tar and sand, and then 2 in. planking, to which the maple flooring is attached. Fig. 3 shows this general type of construction. The roof is constructed of concrete approximately 7½ in. thick, and is usually designed for a load of 60 lb. per sq. ft., which is considered to be sufficient to take care of a shafting load. In many cases there is considerable humidity due to process work, in the room below the roof, in which case a special cork insulation is used.

TABLE 1. GIVES FIGURES SHOWING GROWTH OF TEXTILE INDUSTRY IN NORTH AND SOUTH CAROLINA

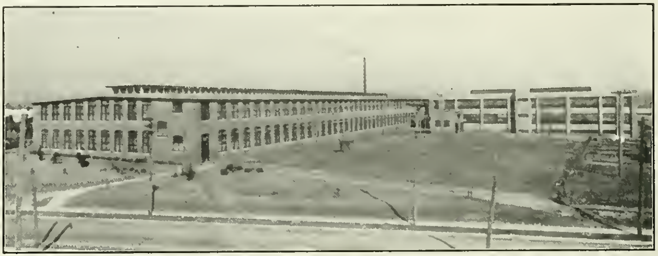
LOCATION	NO. OF SPINDLES		PERCENTAGE OF INCREASE IN 12 YEARS	VALUE OF PRODUCT		PERCENTAGE OF INCREASE IN 12 YEARS
	1910	1922		1910	1922	
N. Carolina	3,163,199	5,605,102	77	$52,868,689	$229,670,691	334
S. Carolina	3,950,800	5,175,672	31	69,475,000	180,218,000	159
United States	28,113,440	31,995,269	14	676,569,115[1]	1,278,220,831	110

[1] 1914 figure, percentage of increase calculated on this basis.

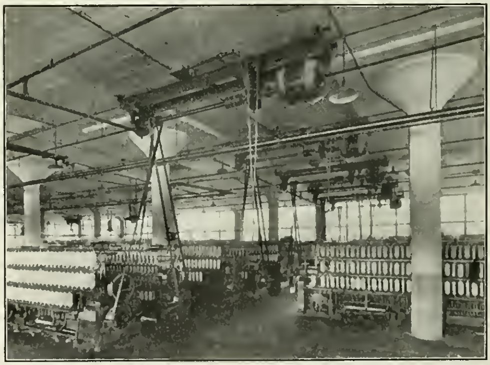
TABLE 2. GIVES AN IDEA OF THE ECONOMICAL SIZE OF A TEXTILE MILL MANUFACTURING YARNS OF VARIOUS SIZES

SIZE OF YARN MANUFACTURED	ECONOMICAL NUMBER OF SPINDLES
Ducks— 8 to 12 yarns	25,000 to 30,000 spindles
30 to 40 yarns	40,000 to 48,000 spindles
Fine Goods—50 yarns	20,000 to 25,000 spindles

There is an increase in window area to wall space in the modern mills and the general practice in the new mills is to have 70 per cent window area to 30 per cent wall area. The interior lighting of these buildings has received careful study, and excellent results have been obtained. The fixtures are spaced on 16 ft. centers, 200-watt lamps being in general use, and with this spacing 0.7 watts per sq. ft. is obtained. On a working plane 3 ft. from the floor this gives 6 to 8 candle-ft., which is all that is required for the usual manufacturing operations in a texile mill. In many cases R. L. M. reflectors, bowl-enameled, are used, and they have been found extremely effective. Fig. 4 shows a good illustration of this type of lighting. The aisle space has also been increased, and the practice in the new mills at this time is to have 34 per cent of the floor area aisle space, and 66 per cent machinery; in general 5 sq. ft. is required per spindle.



Courtesy of J. E. Sirrine & Co.
FIG. 2 CHANGE IN TYPE OF MILL CONSTRUCTION SHOWING OLD TYPE AT LEFT AND NEW AT RIGHT



Courtesy of J. E. Sirrine & Co.
FIG. 3 CARDING-ROOM SHOWING UNDER SIDE OF CONCRETE FLOOR CONSTRUCTION AND CONCRETE COLUMNS

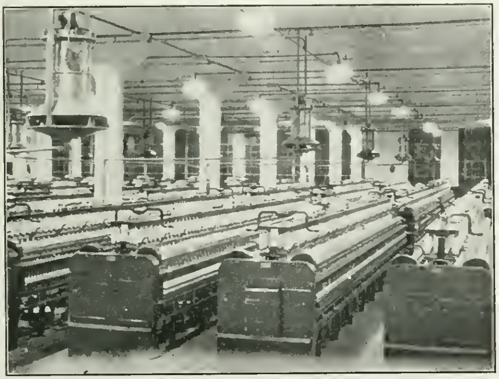
Considerable attention is now being given to sanitation, and the lavatories are usually located in the stair towers which also contain the electric-wiring and piping. These lavatories contain modern plumbing and fixtures and they are a great improvement over the lavatories in the old mills.

The fire protection equipment is standardized due to the insurance regulations. Sprinkler systems are now installed, although there are no elaborate alarm arrangements such as are found in northern factories.

The water-pumping system for fire protection is of the same general type as was mentioned in the description of the older mills.

The heating is usually a low-pressure return system with thermostatic control, and 70 deg. fahr. has been found to be a desirable temperature to maintain in the mills. The temperature of the spinning-room is usually higher than is desirable, due to the large number of machines in constant operation; and the weaving-room, in summer, is usually cooler than the outside temperature, due to the large amount of evaporation which takes place.

There are two systems in general use for the humidification of the textile mill in this section, a central and an individual system. The central system is mainly used where there is a demand for clean air, and costs from 20 to 25 per cent more than the individual system, as ducts must be constructed throughout the mill and a certain amount of additional space is used in excess of that required by the individual system. The individual system consists of humidifiers in different parts of the room, the humidity being controlled by hygrometers. Fig. 4 shows the individual humidifiers with motors attached. This system is used in the majority of cases, and it is considered to give a more even distribution of humidity than the central system. Table 3 shows the per cent of humidity in the product while undergoing the various processes in the average cotton yarn mill.



Courtesy of J. E. Sirrine & Co.

FIG. 4 MODERN SPINNING-ROOM SHOWING ARRANGEMENT OF LIGHTING FIXTURES AND INDIVIDUAL HUMIDIFIERS

With regard to material handling equipment, the general opinion is, that if a mill is well laid out, very little is necessary. In the main, small hand-trucks are in general use and very few of the new mills have expended money for elaborate conveying equipment. The mill-owners seem to feel that not only is the space of value that this equipment would occupy, but that the actual cost, if invested in production machinery, would produce a higher return. In the older mills, however, certain conditions, due to expansion, have, in many cases, made an investment in this type of machinery necessary. These instances are rare.

In the manufacture of textiles, the space occupied by the machinery is large in proportion to that required by the operator. Hence, the cubic feet of air per person is ample, and special ventilation is not a question requiring consideration.

TABLE 3. SHOWS PER CENT OF HUMIDITY IN PRODUCT WHILE UNDERGOING THE VARIOUS PROCESSES IN AVERAGE COTTON YARN MILL

	PERCENTAGE OF HUMIDITY	GAIN	LOSS
Raw stock	10	...	......
After opening	4½	..	5½
After carding	5½	1	......
After roving	6	½	......
After spinning	7	1	......
After spooling and warping	8½	1½	......
After weaving	11	2½	......
Finishing	9	......	2½

In the construction of new mills, expansion is sometimes provided for by building a false end on the mill so that this may be readily removed when it is necessary to erect an additional section. When the older mills now desire to expand they usually construct a separate weave shed and remove their looms to this building, thus allowing them to install other machinery in the place occupied by this equipment. These weave sheds are single-story buildings, and are constructed with concrete or brick pilasters, with steel sash between, which allows a wide glass area, thus admitting the large amount of light which is required for this work. The roofs are constructed of hollow tile and saw-tooths, which are constructed of steel sash and are supported by reinforced concrete beams, in some cases resting on cast iron columns. The under-side of these roofs is given a coat of white plaster, and the hollow tile, acting as an insulator, does not require the cork that is necessary on roofs constructed of other types of material. Where the roof is of reinforced concrete, one inch of cork insulation is generally used, and gutters are installed to care for the condensation. In these weave sheds the lighting is of greater intensity than in the other parts of the textile mills. The spacing is the usual 16 ft. for the fixtures which are of R. L. M. type, bowl-enameled, but 300-watt lamps are installed, which give 1.2 watts per sq. ft. for machine spaces. A modern weave shed of saw-tooth construction is shown in Fig. 6.

TABLE 4. ESTIMATE OF COST[1] OF TYPICAL COTTON MILL AND MILL VILLAGE, 1923. 20,160 SPINDLE MILL

Production 24,000 lb. per week—39 in. Goods—Yarn Nos. 30 to 40

TOTAL COST—$1,262,000		PERCENTAGE OF TOTAL COST
Mill building	$168,000	13.32
Warehouses	13,000	1.04
Boiler- and pump-houses	3,000	0.24
Fire protection	33,000	2.63
Boilers and heating system	11,000	0.88
Humidifier system	15,000	1.19
Lighting and elevators	8,000	0.64
Textile machinery	467,000	37.00
Motors and wiring	91,000	7.18
Shafting and belting and supplies	40,000	3.17
Bungalow type houses (350 rooms)	149,000	11.80
Machine shop	7,000	0.55
Power plant	131,000	10.38
Village water and plumbing	23,000	1.82
Village lighting	5,000	0.40
Engineering and general expenses	98,000	7.76

[1] Cost per spindle, exclusive of operators' village, $53.81.

The cost of a textile mill of modern construction is roughly $55 per spindle. This cost takes into consideration the construction of a mill village for the operators with lighting and plumbing. The houses in these modern villages are of the bungalow type and are composed of from 3 to 5 rooms. They are either built of shingle or clapboard and are constructed on brick or concrete piers. Electric-lighting fixtures are installed and current is supplied by the mill. These houses are equipped with water and sewer connections and in many villages the streets are paved and lighted by the mill. Schools are built and maintained by the mill-owners for the children of the operators, and in these villages there is constructed a welfare house, which is the center of the social activity of the mill village. The beneficial effect of these modern villages upon the labor situation in the Piedmont section will be discussed in detail in a later article. The cost of these villages is about 15 per cent of the total cost of the mill. Table 4 shows the average cost of a print cloth mill and mill village containing 20,160 spindles, working on 30 to 40 yarns and producing 39-in. goods, at the rate of 24,000 lb. per week. This estimate is for a mill constructed of reinforced concrete with modern machinery and individual electric drive, and with a modern mill village.

																			Control Devices				
Location	Drive	Number Motors	Horse Power	R P M	Ventilating screen features	Totally enclosing features	Moisture proof treatment	Waste packed bearings	Oil ring bearings	Gear or chain drive with tapered shaft	Gear or chain drive with straight shaft	Belt Drive	Mounted on machine	Mounted on ceiling	2 Frame Drive	4 Frame Drive	3 Phase - 60 Cycle - 550 Volts	3 Phase - 60 Cycle - 220 Volts	Safety type switches with time limit fuses	Enclosed magnetic switches with time limit thermal relays, under-voltage release, arc chutes and magnetic blow-outs	"Stop" and "Start" push button stations for each magnetic switch. "Jog" button stations for each magnetic switch	Shipper rod operated master switches for use with magnetic switches. These master switches to be so constructed and connected that the magnetic switch will remain open on the resumption of voltage after a shut-down of the power supply	Automatic hand operated starting compensators with two series trip coils equipped with time limit features, under-voltage release device, safety jack testing type disconnecting switch attachments with adapters and arranged for conduit wiring
Opener Room	Openers	1	15	1200					x			x		x			x						x
Picker Room	Condenser and Fan	1	7½	1200	x		x	x				x		x			x						x
Picker Room	Breaker	1	7½	1800	x		x	x				x	x				x			x	x		
Picker Room	Intermediate	2	5	1800	x		x	x				x	x				x			x	x		
Picker Room	Finishers	2	5	1800	x		x	x				x	x				x			x	x		
Card Room	Cards	2	10	1200					x		x			x			x						x
Card Room	Cards	1	20	1200					x		x			x			x						x
Card Room	Drawing Frs	2	5	1200	x			x		x			x				x			x	x		
Card Room	Roving Frs.	4	15	720					x			x		x		x	x			x	x		
Card Room	Roving Frs	4	7½	720					x			x		x	x		x			x	x		
Spinning Room	Spinning Frs	45	7½	1800	x			x		x			x				x			x		x	
Spinning Room	Spoolers	6	1	1200		x		x		x			x				x		x				
Spinning Room	Warpers	1	5	1200	x			x				x		x			x			x	x		
Slasher Room	Slashers and Fans	1	10	1200					x			x		x			x						
Weave Room	Looms	282	½	1800		x		x		x			x					x	x				
Cloth Room	Machinery	1	20	1200					x			x		x			x						x
Machine Shop	Machinery	1	10	1200					x			x		x			x						x

FIG. 5 TYPICAL MOTOR LIST FOR A 10,000 SPINDLE PRINT CLOTH MILL

Cost of Plant

An analysis of Table 4 shows that the textile machinery is the largest individual item, being 37 per cent of the cost of the mill. The next largest is the cost of the mill building, which is over 13 per cent. The amount required to construct the operators' houses is an important part of the total cost, being 11.8 per cent, and if the lighting and water-supply is added, the cost of the completed mill village is more than the cost of the mill building. The amount of power required by a textile mill of a certain spindlage is shown by the curve in Fig. 9. For a mill of 20,000 spindles working on 30 to 40 yarn, approximately 1 kw. of electrical energy would be required for every 35 spindles or roughly 600 kw. The sum of $131,000 included for a power plant in the estimate given above was for a plant of this capacity. This amount would probably be necessary for the construction of a power plant if the mill were located on a water-power site, or the owners desired to generate their own electrical energy by steam. However, in the majority of cases the mills in the Piedmont section purchase their energy from the public utility companies, and, therefore, this amount should be reduced the difference between the cost of a power plant and the cost of an individual transformer station, which would be roughly $121,000.

A steady and economical source of power is of prime importance to the textile industry, and this has been available to the mills in the Piedmont section. The huge power demand of this industry has been met, in the main, by the Southern Power Company, which supplies this section, and which has an installed generating

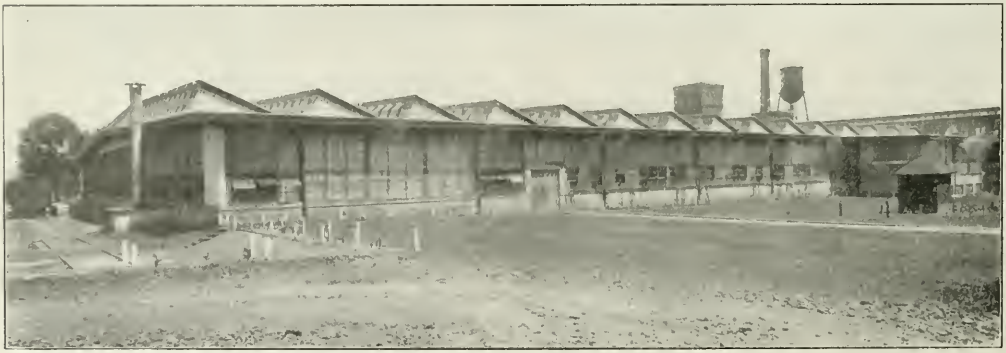
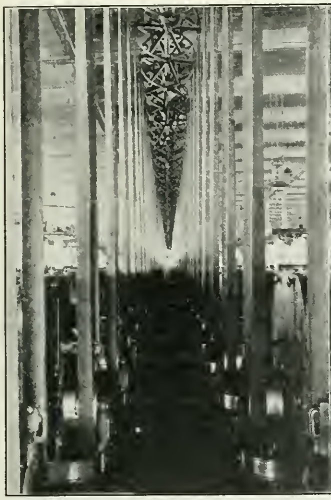

Courtesy of J. E. Sirrine & Co.

FIG. 6 MODERN WEAVE SHED OF SAW-TOOTH CONSTRUCTION



Courtesy of J. E. Sirrine & Co.

FIG. 7 AISLE IN SPINNING-ROOM SHOWING BELT DRIVE

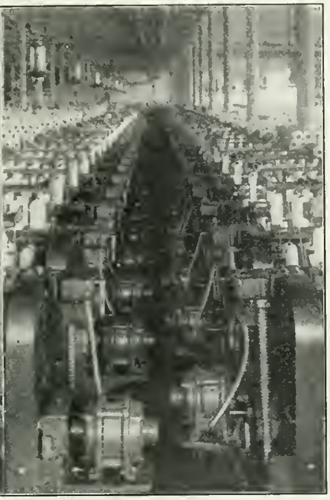
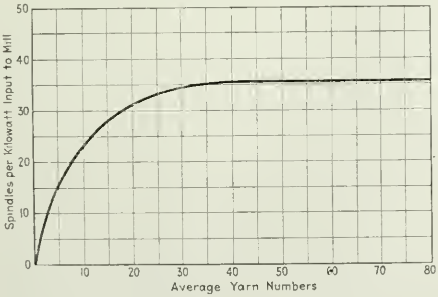


FIG. 8 SAME AISLE AFTER INSTALLATION OF INDIVIDUAL MOTOR DRIVE

capacity of 468,150 kva.[2] The current to operate these mills is 3-phrase, 60 cycle, and is transmitted throughout this territory at 44,000 and 100,000 volts, the distribution voltage to the mills being usually 13,000.

The method of drive on the various machines is of special interest to the mill-owners in the Piedmont section. In the older mills there is still a considerable amount of shafting, but in the more modern mills individual and group drives are used, the individual drive being adopted in the great majority of cases by those mills now under construction. At the present time approximately 70 per cent of the mills are electrified, 55 per eent being group drive, and 15 per eent having individual motor installations wherever this is advisable.



Courtesy of J. E. Sirrine & Co.

FIG. 9 AVERAGE POWER REQUIRED TO DRIVE COTTON WEAVING MILLS

When the method of driving a mill by one large pulley and shafting gave way to the installation of motors, the first step was the driving of large groups of machines by a motor and shafting. The size of these groups became smaller as various types of motors and controls were developed to meet the requirements of the individual textile machine until individual drive was developed. Space is not available in this article to discuss the subject of individual and group drive in detail, but there are several main points in favor of individual drive that are of particular interest. In group drive the use of large motors driving shafting through the medium of belts means a considerable loss from belt slippage. This loss is still further increased as the lint and oil accumulating on the belts increase normal slippage to a considerable extent. Textile machinery is built to run at practically constant speed, and the lowering of this speed, due to belt slippage, means an appreciable loss in production. With group drive throughout a mill any trouble that may cause the shut-down of a motor, affects a number of machines that would not be affected were individual drive installed, thus causing a further loss in production. Where individual drive is used, smaller motors are installed, which can be handled more easily, and with proper standardization spare parts can be kept on hand, thus allowing immediate rectification of trouble of this kind.

In Fig. 7 is shown the aisle of a spinning-room as it was when the machines were driven by belts. It was not the safest place for the operator to walk. In Fig. 8 is the same aisle after the installation of individual motor drive.

The motors used for textile mills are mainly of the induction and synchronous type, and the voltage used in the mills of this section is usually 500, with the exception of the small motors used on the looms, which generally operate at 250 volts. In a modern mill the method of drive, shown in Table 5, is considered the best practice.

TABLE 5. SHOWS METHOD OF DRIVE IN A MODERN TEXTILE MILL

Openers and pickers	Individual motors connected to machines by short belts. This method is necessary as it is not always possible to obtain motors running at the same speed as the machines. It gives satisfactory service with little power loss.
Cotton cards	Moderate-size motors driving small groups
Combing	Individual motor drive
Drawing	Individual motor drive
Roving	Four-frame, small group drive
Spinning	Individual motor drive
Spooling	Small group drive, or individual motor drive
Warping	Small group drive.
Slashing	Group drive
Weaving	Individual motor drive
Humidifiers	Individual motor drive

In the manufacture of textiles many of the operations require a high percentage of humidity in the room where these operations take place. It is necessary, therefore, that certain of the motors be moistureproof. In other operations they are totally enclosed as in the weave-room. Waste-packed bearings are used in the motors with the exception of those operating in the opening-room and those driving the cards, the roving machines, and the slashers, these motors being equipped with oil ring bearings. The motor controls that have been developed have played a considerable part in the development of individual drive and are an important part of the electrical installation. In Fig. 5 there is given a typical motor list for a 10,000 spindle print cloth mill, which shows the various types of motors and controls used. From an inspection of this table it can readily be seen that the textile mills of the Piedmont section are as well equipped electrically as any in the United States.

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[2] See MANAGEMENT AND ADMINISTRATION for May 1924, p. 520.

The foregoing brief description of the mills in the Piedmont section has not touched on the finishing plants. These occupy a place in the industry important enough to warrant special discussion, and will be taken up later.

The author wishes to express his appreciation to J. E. Sirrine and his organization for assisting him in the accumulation of the data contained in this article. His large engineering organization has undoubtedly played an important part in the development of modern textile mill construction in this section. In the vicinity of Greenville, Gastonia, Greenboro, Charlotte, and Winston-Salem, there are being built a number of new textile mills, that are equipped in conformity with the best modern practice.

THE next article, which will be in the August issue, will take up textile finishing plants, and the furniture and tobacco industries. —THE EDITORS.

Vacations for Factory Workers

Index Number
658.3816 Vacations

FOR a number of years office employees in the large majority of manufacturing plants throughout the country have been granted an annual vacation, usually with pay, and following the policy adopted by business and mercantile establishments for the rank and file of their employees.

The cost of these vacations has been figured in, perhaps unconsciously, with the calculation of rate of pay. Like the fewer hours of work, which until recently characterized clerical work as distinct from factory employment, it ultimately entered into the salary question.

Recently the vacation privilege has been extended to factory workers in a great many plants. This tendency is especially marked among the larger manufacturing enterprises. It involves two major considerations—determination of policy regarding the reward features and essential wage increases which it signifies, and adjustment of work to prevent disorganization and interruption of production.

A two weeks' vacation with pay, and not accompanied by a wage reduction, amounts to an increase of 4 per cent in pay. It is unlikely that lost production will be made up directly, especially if the daily output per person has approached a reasonable maximum, on the average. At any rate, this is probably the best assumption for the manufacturer to make. Actually, he will profit well in the end because of the increased physical and mental vigor, and the reduced absence from illness or "laying-off," on the part of his employees.

The disorganization and interruption of production is a more immediate problem and it places a definite responsibility on the management.

Many concerns now make vacations for factory employees as much of an individual matter as those for office help. Among these is The Paraffine Companies, Inc., which has been working for some time on a plan to extend the benefits of a yearly vacation to factory as well as to office employees. The company has put into force the following plan, effective at its Emeryville plant for the year 1924:

Vacations with pay will be granted to all employees of The Paraffine Companies, Inc., on the following basis:

Over three years' but less than four years' continuous service on January 2, 1924.. 1 week
Over four years' but less than five years' service ....10 days
Over five years' service .... 2 weeks

1. Choice of vacation time will depend on
    (*a*) Approval of Department Head and General Superintendent.
    (*b*) Seniority of employment with the company.
2. A list will be posted showing the vacation each employee is entitled to and the order of his seniority.
3. Employees will be requested to put in first, second, and third preferences of vacation time. They will be notified later as to when they are to take their vacation.
4. The management reserves the right to change the schedule if conditions of work make it necessary.
5. Employees will be paid up to the date on which they start on their vacation, and payment for the vacation will be made on the regular pay day following their return. Before going on their vacations employees must call at the Personnel Department for wages, to date, and on returning must report there for duty.
6. Continuous service will mean continuous employment in any plant or department, except that a period not to exceed 30 days' lay-off on account of slack work will not be considered as a break in the continuity of services. When an employee is granted a leave of absence for a period of more than 30 days, such leave of absence will, of course, be deducted from the amount of accumulated service. Men going on leave should get a certificate to that effect. (Note: Service interrupted by men going to war will count as continuous service).
7. The rate of pay during the vacation period will be based upon an employee's regular normal rate. By this is meant that if a man is getting a higher rate, owing to temporarily taking the place of some other employee, he will not continue at this rate during his vacation, but at his normal rate of pay. If the plant is closed on account of a holiday during an employee's vacation, these days will count as working days for vacation or pay purposes.
8. It is hoped that the vacation plan, as announced above, will be appreciated and not abused, as it is the desire of the company to make the plan a permanent one. Its success depends on the action of the men affected and each man should realize that on the character of his work and the regularity of his attendance depend not only his own vacation but the vacations of all of those working with him.

Recording Job Costs to Show Profits

Profitable Methods for the Small Factory—VI[1]

By GEOFFREY C. BROWN
Chief Engineer, Jacques Kahn, Inc.

Index Number
658.5:657 Shop accounting
657.452 Cost accounting

THE present status of cost accounting in our small factories is similar to the status of cost accounting throughout industry as a whole 30 years ago—that is, it is conspicuous chiefly by its absence. Most small plants are in possession of a general accounting system, although there are doubtless occasional establishments where even this primal element is missing. Assuming, however, as we may safely do, that the majority of them keep general books and employ an accountant or a bookkeeper, let us briefly examine the character and value of the information thus afforded.

The individual entries which, in combination, comprise the ledger accounts, are drawn from definite sources such as pay-rolls, purchase orders, invoices, and sales bills. These entries are posted as the items occur; for instance, labor expenditures are entered weekly or monthly, depending on the character of the pay-roll. Expenditures for material or supplies are entered subject to the dates appearing on purchase orders or invoices. Sales amounts are usually posted in Sales accounts, although these amounts frequently will be found buried in a Merchandise account, along with materials purchased. By carrying all regular expenditures to one side of a Trading account, and the total sales value to the other side, and then subtracting the former from the latter, a gross profit for the year is determined. This gross profit is then carried to a Profit and Loss account, on the other side of which appears all extraordinary expenditures incurred throughout the year. The net profit is simply arrived at by subtracting this extraordinary expense from the gross profit.

The general books might thus be said to show total income and disbursements, without reference to customer's orders, lines of product, manufacturing departments, manufacturing operations, or months of the year. The initial cost of material going into each customer's order is usually evident, and the cost of shipping out the completed order may be, and usually is, quite clear; but the intervening cost of manufacture in its relation to the important aspects just mentioned is, in a vast majority of our small plants, an unexplored hinterland, or economic morass, into which material regularly disappears, and from which it emerges sometime, somehow, as a manufactured product. If, at the end of the year, the book-closing shows a profit, it can only signify that the fates throughout the year have been propitious; and if a loss appears it must, for lack of a better explanation, be similarly regarded as a visitation from the unseen.

All manner of unfavorable events, the significance of which the general books in their nature would not reveal, may have transpired during the year. The cost of certain materials may have so advanced as to render their use unprofitable. The selling price on certain lines or articles of product may have fallen to a point where these lines could not be produced other than at a loss. Imminent falling prices may have rendered imperative a reduction in inventories by the sparing purchase of materials. Any one of these possibilities demands that cost features, and profit or loss amounts, be recorded in terms of customers' orders, lines of product, manufacturing departments, manufacturing processes, and months of the year. It was precisely this information that our small industries lacked before and during the recent depression, and which the great majority of them may be said still to lack today.

Recording Daily Costs on Customers' Orders

In the preceding article,[2] the subject of overhead expense, its nature, the manner of its predetermination, and the various methods for its proper allocation to shop orders, was discussed in detail. This article will therefore assume that overhead has been predetermined and distributed by one of the methods then described, and will consider only the actual recording of monthly costs as they occur in the small factory. Such a consideration will resolve itself into a number of consecutive stages, corresponding to similar stages in the functioning of a cost system. These stages are as follows:

1. The daily recording of costs on customer's orders as they pass through manufacture.
2. The assembly or summarizing of these recorded costs, into totals for each shop order.
3. The preparation from these summaries of whatever representations, in the form of analyses, statements or graphs, are necessary in order to convey to management a clear and authentic picture of the month's activities.

The first of these three stages, that of recording the *daily* costs, in labor, material, and overhead incurred by each customer's order, may be regarded as the basic one, and it is represented by a Monthly Cost Sheet (Fig. 18), which is the basic record in any cost department.

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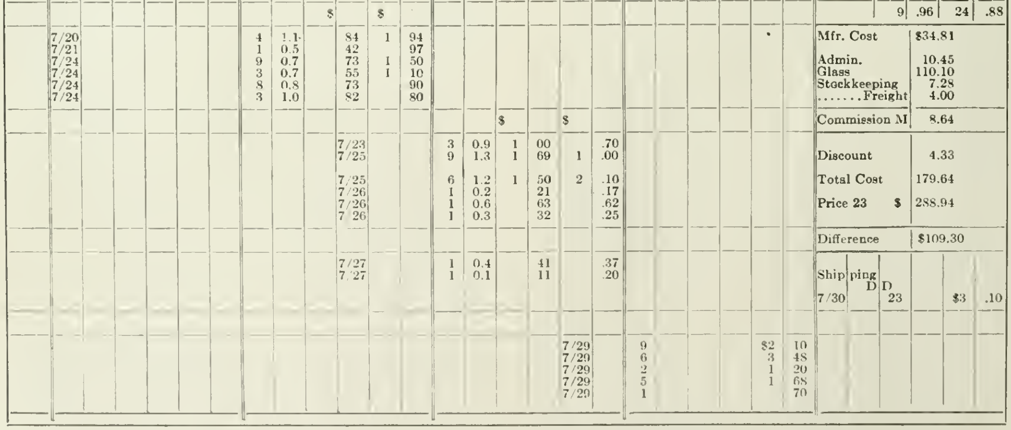
[1] Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION for February 1924, p. 161; March 1924, p. 305; April 1924, p. 431; May 1924, p. 567; June 1924, p. 683.

[2] MANAGEMENT AND ADMINISTRATION for June 1924, p. 683.

In the small factory, this first stage is peculiarly the function of the cost clerk, who maintains a file of cost sheets—one for each order entering the factory—keeps these sheets properly posted, and is responsible for the correctness of the entries. In factories with personnels of less than 100, a single cost clerk can usually, without undue pressure, keep all the cost sheets properly posted. In larger establishments, where the accumulation of cost sheets is necessarily greater, the cost clerk may perhaps require one or more assistants as circumstances demand. This feature is also controlled to some extent by the character of manufacture. For instance, in plants where relatively small quantities of many different articles or lines of product are turned out, there will naturally be a greater accumulation of cost sheets than there would be if the individual orders were fewer and manufactured in greater quantity.

The writer has found that a satisfactory distribution of cost department routine may be usually attained in a small organization by spreading the work, in some fashion, over the planning office; different members of the planning staff in this way taking care of different cost details, in addition to their regular functions, which may not nominally be connected with cost-finding. Thus, at the Jacques Kahn plant, the factory clerk is responsible for the [3] workman's production or job cards only from the standpoint of *time*. When he has ascertained the length of time that the workmen spent on each manufacturing order or assigned task, throughout the day, and has made the proper entries in the "Elapsed Time" column of each workman's card, his responsibility is ended. The cards, at this point, pass to the scheduling clerk, who, in addition to his regular function of scheduling orders through manufacture, is responsible for converting this elapsed time into dollars of direct labor and overhead expense. This he accomplishes quite simply by multiplying the time spent on each shop order, first, by the workman's wage rate, and then by the corresponding machine hourly expense rate. Then he enters the labor and expense amounts thus obtained in the proper "Wages" and "Expense" columns. The production cards are now passed to the cost clerk, who transfers the labor and expense amounts to the proper cost sheets. By distributing the work in this manner, an economical division of cost finding routine, appropriate to the reduced demands of a small organization, is readily obtained. An additional advantage is found in the fact that all members of the planning staff, in a comparatively short time, become familiar with the cost system—a development which is obviously desirable.

The Cost Sheet reproduced in Fig. 18 is thoroughly typical, and while modifications in form may be necessary to adapt it to the problems of individual small organizations, it illustrates in a satisfactory manner the daily routine of cost accounting. It will be observed that this form has vertical subdivisions, one for each manufacturing department; and that each subdivision is further divided into four vertical columns under the captions — "Production," "Hours," "Wages," and "Expense". The operations shown above the depart-



CUSTOMER Smith & Jones QUANTITY 23 ORDER NO. 4825

Oper.	Shaping						Polishing						Machining						Silvering						Summary				
Dept.	D.C.						D.P.						D.M.						D.S.										
Date	Prod	Hrs	Wages		Expense		Prod	Hrs	Wages		Expense		Prod	Hrs	Wages		Expense		Prod	Hrs	Wages		Expense		Dept.	Wages		Expense	
7/19	10 10 3 23																								DC. DP. DM. DS. DD.	 $4 5	 .09 .87	 $7 5 9 3	 .21 .41 .16 .10
									$		$															9	.96	24	.88
	7/20 7/21 7/24 7/24 7/24 7/24						4 1 9 3 8 3	1.1 0.5 0.7 0.7 0.8 1.0		84 42 73 55 73 82	1 1 1	94 97 50 10 90 80													Mfr. Cost Admin. Glass Stockkeeping ....Freight	$34.81 10.45 110.10 7.28 4.00			
															$		$								Commission M	8.64			
										7/23 7/25 7/25 7/26 7/26 7 26			3 9 6 1 1 1	0.9 1.3 1.2 0.2 0.6 0.3	1 1 1	00 69 50 21 63 32	 1 2	.70 .00 .10 .17 .62 .25							Discount Total Cost Price 23 $	4.33 179.64 288.94			
																									Difference	$109.30			
										7/27 7/27			1 1	0.4 0.1		41 11		.37 .20							Ship ping D 7/30	D 23		$3	.10
																	7/29 7/29 7/29 7/29 7/29		9 6 2 5 1				$2 3 1 1	10 48 20 68 70					

FIG. 18 TYPICAL COST SHEET, SUITABLE FOR USE IN A SMALL FACTORY COST DEPARTMENT. A SEPARATE COST SHEET IS MAINTAINED FOR EACH SHOP ORDER ENTERING THE FACTORY

mental subdivisions in the figure are, by the way, those that occur in the fabrication of a mirror. The major duty of the cost clerk, as mentioned earlier, consists of maintaining a file of these sheets, one for each order, and throughout the day posting from the workman's daily production or job cards for the previous day, the labor and overhead cost that each order has incurred.

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[3] MANAGEMENT AND ADMINISTRATION for March 1924, p. 305.

The second stage in cost accounting, that of summarizing the daily cost amounts into totals for each order, is reached when the order has been manufactured and shipped, and it is therefore necessary to total up the corresponding cost sheet and remove it from the active file. This stage is provided for in the vertical subdivision entitled "Summary," appearing at the right-hand side of the cost sheet.

DEPT. Polishing **DATE,** Aug. 24, 1923

	Mach. No.	Stopped					Started	Stopped					Started	Elapsed Time	Exp. Rate	Expense of Idleness				
		No Work	No Mat'l	No Tools	No Help	Rep's		No Work	No Mat'l	No Tools	No Help	Rep's				No Work	No Mat'l	No Tools	No Help	Rep's
	201				9.4		10.7				1.4		3.4	3.5	0.250				0.88	
D. P. M	204		8.0				8.6		11.0				11.6	1.2	0.250		0.30			
	305	8.0												8.0	0.212	1.68				
	306	8.0												8.0	0.212	1.68				
	307		9.8				10.7							0.9	0.212		0.19			
	401				8.0		9.4				10.9 3.4		1.4 4.5	4.5	0.512				2.30	
	405	8.0					9.7					11.0	11.5	1.7 0.5	0.512	0.87				0.26
	406			3.3			4.0							0.7	0.512			0.36		
	407			3 3			4.0							0.7	0.512			0.36		
	408				8.0									8.0	0.512				4.08	
	603	8.0					10.0							2.0	0.250	0.50				
	604	8.0					12.0							4.0	0.250	1.00				
	706		8.0											8.0	0.250		2.00			
	709		8.0											8.0	0.250		2.00			
	1101	8.0												8.0	0.070	0.56				
	1301	8.0												8.0	0.029	0.23				
	1302	8.0												8.0	0.048	0.38				
													Totals			6.90	4.49	0.72	7.26	0.26

Total Idleness Expense	19.63
Total Active Machine Expense	73.17
Total Department Expense	92.80

FIG. 19 DAILY IDLE MACHINE REPORT

The cost clerk should, in furtherance of this and subsequent stages, be able to use and have the use of, an adding machine, as the summarizing of labor and expense amounts, and their subsequent check, can in this way be accomplished quickly and accurately; whereas without an adding machine, the operation becomes at best an arduous one, and, where the accumulation of cost sheets is considerable, a well-nigh impossible one.

A glance at the right-hand column of Fig. 18 should render clear the procedure of summarizing cost sheets as orders are completed. The departmental "Wages" and "Expense" totals appear in the upper section of this summary, the sum of these totals constituting, in this case, the "Factory Cost" of the order. To the factory cost are added:

1. Administrative cost ....30 per cent of factory cost.
2. Raw material cost.....Actual from [4] stores inventory cards.
3. Stockkeeping cost .....10 per cent of raw material cost.
4. Freight ....Actual.
5. Commission ....A definite percentage of sales value.

The sum of the above elements gives the total cost of the order, which is entered beside "Total Cost," as shown in Fig. 18. The sales value is next entered beside "Price". The difference between "Total Cost" and "Price" constitutes the profit or loss, as the case may be, and this final entry is made beside "Difference". The cost sheet is now summarized and may be transferred from the active file to a suspense file, where it will remain, with other completed cost sheets, until required at the end of the month.

Idleness Expense

The cost sheets thus show what has actually been expended in material, labor, and approximate overhead, to produce and ship each customer's order. There is, however, an additional element of expense, which is incurred, to a greater or less extent, in all manufacturing establishments, and which may not, in all fairness, be included as a legitimate element of manufacturing cost. This is the expense which accumulates in each manufacturing department as a result of maintaining the productive equipment for some part of the month in a state of idleness.

Were it possible to keep every manufacturing operation active and running at full capacity through every hour of the working month, obviously there would be no such thing as idleness expense. This highly desirable condition is seldom attained in any factory, and through such familiar causes as lack of orders, lack of material, lack of help, lack of tools, repairs, etc., most of the producing units have varying intervals of inactivity, during which their proportions of overhead expense are accumulating, while nothing is being produced.

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[4] See MANAGEMENT AND ADMINISTRATION for March 1924, p. 305.

The proper treatment of this feature of expense has, in the past, been a source of much controversy. H. L. Gantt, in 1917 read a paper before the American Society of Mechanical Engineers on "Expenses and Cost," during the course of which he ventured, humorously, that managers and accountants "had not before realized that it cost something to be idle". His contention, in substance, was that the expense incurred through idleness was not a legitimate part of manufacturing overhead, and should not be allocated to customers' orders as such. It should rather be recorded and classified by causes, its aggregate being finally treated on the books as an element of extraordinary expense to be deducted from the month's profit, along with other extraordinary expense.

Mr. Gantt's claim was logical, and has borne fruit in a growing recognition that much industrial idleness is due to some inadequacy in sales or factory management, and is avoidable; and that, in any event, the customer should not be made to bear this expense by having it included in the cost of the product. The proper attitude to assume toward idleness expense is to regard it as an unfortunate source of financial loss, and by carefully recording it, and scrutinizing its causes, to concentrate on reducing it to a minimum.

In order to maintain a separate record of departmental idleness expense, it is necessary systematically to enter this expense on a daily idleness report. The Daily Idle Machine Report, reproduced in Fig. 19, is well suited for this purpose. It will be observed that this form has vertical columns for "Machine Number," and for the time during which machines were held up each day owing to "No Work," "No Material," "No Tools," "No Help," and "Repairs". The subdivision at the right of the form provides a summary in which the daily expense corresponding to each classified cause may be entered, this expense being determined by the simple operation of multiplying the elapsed idle time for each machine by the proper machine hourly expense rate. One of these reports for each manufacturing department may thus be filled in every day by the factory clerk, and then sent on to the planning office, where it will be scrutinized and then placed in a suspense file. At the end of the month all the daily idleness reports for the month may be withdrawn from this file, figured into monthly departmental idleness expense totals, and finally utilized in the preparation of a Gantt Monthly Idleness Chart (Fig. 22) for each manufacturing department.

We now come to the third stage, which consists, as stated earlier, of preparing from the month's accumulation of cost sheets, whatever analyses, statements, or graphs are necessary to convey to the management and directorate an authentic picture of the month's activity.[5] In a previous article this was described as:

> . . . . the focal stage upon which the daily details of cost department routine converge, and during which a cost system might be said to justify its existence by revealing the comparative profit or loss from individual orders and in a general way by visualizing the month's activity so as to indicate a wise manufacturing or selling policy for the future.

COST ANALYSIS—March, 1922

LINE	SALES	COST	PROFIT OR LOSS	PROFIT OR LOSS PER CENT OF SALES
	PROFITABLE ORDERS			
A	$29,816	$23,556	$6,260	+21
B	17,856	14,338	3,518	+19
C	4,388	3,360	1,028	+23
D	5,892	3,916	1,976	+33
E	2,768	2,092	676	+24
F	2,450	1,674	776	+31
G	912	612	300	+32
Total	$64,082	$49,548	$14,534	....
	UNPROFITABLE ORDERS			
A	$1,120	$1,190	$ 70	− 6
B	9,870	11,942	2,072	−21
C	1,614	1,912	298	−18
D	20	22	2	−10
E	450	516	66	−15
F	1,138	1,318	180	−16
G	140	186	46	−33
Total	$14,352	$17,086	$2,734	....
	TOTAL ORDERS			
A	$30,936	$24,746	$6,190	+20
B	27,726	26,280	1,446	+ 5
C	6,002	5,272	730	+12
D	5,912	3,938	1,974	+33
E	3,218	2,608	610	+18
F	3,588	2,992	596	+16
G	1,052	798	254	+24
No charge	....	210	−210	....
Total	$78,434	$66,844	$11,590	....
Total Idleness Cost		$12,444		
Devaluation of Inventory		76		
Total	....	$12,520	$12,520	....
Net Operating Loss on completed orders		....	$930	− 1

FIG. 20 TYPICAL MONTHLY COST ANALYSIS OF COMPLETED ORDERS AS PREPARED BY SMALL FACTORY PLANNING OFFICE

In small organizations this third stage may be regarded as an active part of the production supervisor's function, for he must now step in and assume personal charge of the month-closing, assisted by the cost clerk and, if necessary, by other members of the planning staff. The character of his task may be readily comprehended when we visualize the accumulation of records with which he must deal. These are:

1. An accumulation of cost sheets which represent orders completed and shipped during the month, and which are in a suspense file awaiting closure.
2. An accumulation of cost sheets representing orders which are only partially completed and shipped during the month, some balance of these orders remaining in process of manufacture at the end of the month. These sheets remain in the cost clerk's active cost sheet file.
3. An accumulation of Daily Idle Machine Reports showing the idleness expense incurred by each manufacturing department during the month.

From these three sets of records, the total manufacturing cost for the month must be expressed in terms of either customers' orders or idleness expense. The comparative profit or loss from individual lines of product, and the aggregate profit or loss for the month must also be determined. The operation of closing the month consists, then, of first arranging by lines of product all cost sheets representing completed and partially completed orders, and totaling their cost and sales amounts. The total cost amount thus obtained, subtracted from the total sales amount, will give the gross cost sheet profit. When the month's total idleness expense has been subtracted from this gross profit, the difference is the net or actual profit (or loss) for the month, as represented by the cost sheets.

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[5] See MANAGEMENT AND ADMINISTRATION for November 1923, "Interpreting Operations to the Directors," p. 593.

The Cost Analysis reproduced in Fig. 20 shows in a simple way the manner in which the month's production of completed orders may be tabulated and analyzed by lines of product. It will be observed that these orders are first classified as "Profitable Orders," "Unprofitable Orders," and "Total Orders". Then, under the captions, "Line," "Sales," "Cost," "Profit or Loss," and "Profit or Loss Per Cent of Sales," appears a detailed analysis of the comparative values of each line of product in these three classes.

MONTHLY STATEMENT OF PROFIT AND LOSS—ASSEMBLED FROM MONTHLY COST SHEETS
March, 1924

TOTAL COST OF PRODUCTION	COMPLETED ORDERS	PART SHIPMENTS FEBRUARY	PART SHIPMENTS MARCH	WORK IN PROGRESS MARCH 31	NET AMOUNTS
Raw material.....	$20,802	$777	$336	$15,130	$20,361
Stockkeeping.....	1,726	39	27	1,200	1,714
Direct labor......	2,328	40	20	1,046	2,308
Mfg. expense.....	4,473	128	65	2,164	4,410
Admin. expense...	2,040	50	27	963	2,063
Selling expense....	2,060	118	53	....	1,995
Total cost........	$33,429	$1,152	$528	$20,503	$32,851
Total sales........	45,500	1,412	635	....	44,723
Difference........	$12,071 Minus Value.	.... Factory Cost Work in Progr	... . —March Part ess March 31,	Gross Profit Ship. 475 $20,028	$11,872
			Total Idleness	Expense.......	$6,222
			Devaluation of	Inventory.....	38
			Sales Value of	Returns.......	836
				Total.......	$7,096
	Net	Profit is $11,872	Minus $7,096		$4,776

FIG. 21 MONTHLY STATEMENT OF PROFIT AND LOSS AS ASSEMBLED FROM COST SHEET TOTALS

At the foot of the analysis, in the "Profit or Loss" column of the "Total Orders" classification, we find a considerable gross profit, the latter, however, being more than offset by high idleness expense and some additional expense due to inventory devaluation. This extraordinary expense, as indicated by Fig. 20, transforms the gross profit on completed orders into a net operating loss. It might be well, at this point, to emphasize the fact that while completed orders may show a gross profit for the month, this profit may be greatly reduced or entirely swallowed up by idleness expense, if the latter during the month has been considerable; hence, the necessity of throwing this expense into strong relief as something to be guarded against in every conceivable way.

The cost analysis, as just described, shows in a comparative way, the actual profit or loss from different lines, and the gross profit or loss on all orders *completed and shipped within the month.* If the closing of the month entailed merely the summarizing of these orders, it could be accomplished with obvious facility. Unfortunately, there is always, at the end of the month, a considerable volume of partially completed orders, and these cost sheets cannot be closed because some proportion of each order still remains to pass through certain manufacturing stages and be shipped. Each month must, however, receive its proper allotment of profit or loss on these partially shipped orders, and no monthly statement can be regarded as correct until such an adjustment has been effected.

A simple way of providing for part-shipment values, is to enter on the lower right-hand corner of each cost sheet, incomplete at the end of the month, the number of pieces shipped, a summary of their manufacturing cost, their sales value, and estimated profit or loss. These values may then be credited to the month in process of closure, the balance of the order with its corresponding manufacturing cost being carried into the next month as work in progress. (Fig. 21).

It becomes necessary, then, to prepare a monthly statement of profit and loss, which is quite independent of the cost analysis and which shows a proper correction for part shipment values. Such a statement is reproduced in Fig. 21, this being the actual Monthly Profit and Loss Statement prepared by a small factory planning office for presentation at monthly meetings of the company's directorate. In referring to Fig. 21, it will be noted that in the two "Part Shipment" columns, part shipment values for the previous month and for the current month appear. The part shipment values belonging to the previous month must be subtracted from the current completed cost sheets totals, appearing at the left, and the part shipment values for the current month then added to this difference in order to close the month with accurate figures. The net amounts thus obtained are the corrected values which appear under "Net Amounts" in the right-hand column.

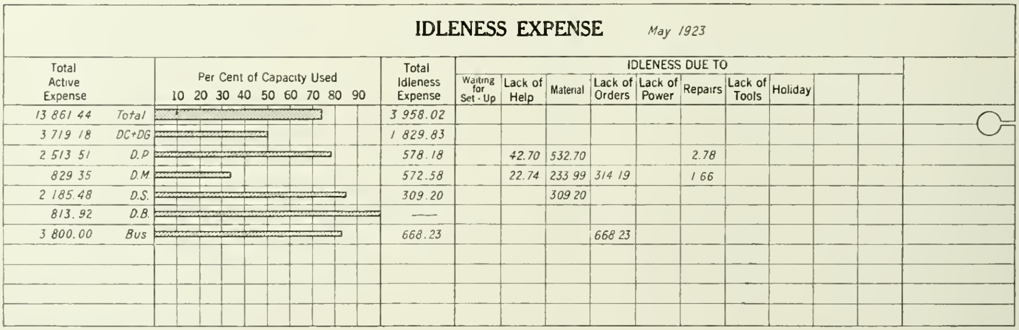
It will be observed, from Fig. 21, that the gross corrected profit for the month (March 1924) was $11,872. When idleness expense amounting to $6,222, also a small reduction of $38 in raw material inventory value, and finally the sales value of returned goods amounting to $836 have been subtracted from this gross profit, the net or actual corrected profit for the month becomes $4,776, which amount appears at the foot of the statement.

The concentration of function and detail that has been featured throughout these articles as fundamental to the organization of a small industry along modern lines, demands that certain duties devolve upon the planning department, which in a large organization usually lie in the province of the secretary or the comptroller.[6] One of these, and an important one, consists of preparing for the directors' meeting, whatever statements and charts are necessary to show clearly what has been accomplished in the interval, usually a month, since the previous meeting. This part of the month-closing has, in earlier articles,[7] been treated in detail, so the writer will not at this time do more than enumerate the various media then produced and explained. It might be mentioned, however, that in the majority of small organizations, it will be wise to include this as part of the production supervisor's function, as by training and experience he should be the person most fitted to perform it. A summary of typical statements and charts for presentation at directors' meetings is as follows:

1. A comparative table[8] showing by departments the month's predetermined and actual overhead expense.
2. A cost analysis of completed orders. Fig. 20.
3. A Monthly Statement of Profit and Loss. Fig. 21.
4. A Gantt Monthly Idleness Chart (Fig. 22), showing by causes and by departments the monthly expense incurred through idleness.
5. Four simple cross-sectional charts[9] showing monthly variations in:
    - (*a*) Value of raw material in stockroom.
    - (*b*) Work in progress inventory values.
    - (*c*) Volume of output and unit costs.
    - (*d*) Total costs and sales.

By means of these or similar representations, the small factory planning office can submit a picture of each month's performance that checks reasonably with the month's business appearing on the general books, adequately represents inventory values, and is drawn entirely from the monthly cost sheets.

This completes our discussion of the three fundamental stages in a system of cost recording suitably concentrated to meet the requirements of a small organization. These three stages, as we have seen, consist of: (1) Recording daily costs on customers' orders as they pass through manufacture; (2) summarizing these daily costs into totals for each customer's order when the latter has passed through manufacture; and (3) at the end of the month, preparing from the summarized cost sheets whatever statements or graphs are necessary adequately to visualize each month's performance. There still remains a fourth stage which, while it possibly may not be included as a fundamental part of cost accounting, yet is so intimately connected with it that we may in concluding, touch briefly upon it. This final stage might be described as, *the interpretation by small factory management of the cost data submitted by the small factory planning office.*



IDLENESS EXPENSE *May 1923*

Total Active Expense		Per Cent of Capacity Used 10 20 30 40 50 60 70 80 90	Total Idleness Expense	Waiting for Set-Up	Lack of Help	Material	Lack of Orders	Lack of Power	Repairs	Lack of Tools	Holiday
13 861 44	Total		3 958.02								
3 719 18	DC+DG		1 829.83								
2 513 51	D.P		578.18		42.70	532.70			2.78		
829 35	D.M		572.58		22.74	233 99	314 19		1 66		
2 185.48	D.S.		309.20			309 20					
813.92	D.B.		——								
3 800.00	Bus		668.23				668 23				

FIG. 22 GANTT MONTHLY IDLENESS CHART

The three important media from which the small factory manager must draw his conclusions and formulate his future policy, are undoubtedly, the Cost Analysis of completed Orders, the Monthly Statement of Profit and Loss, and the Gantt Monthly Idleness Chart. Of these three, the cost analysis possesses, perhaps, greatest utility, because it throws into relief the comparative economic values of different lines of product and indicates which of these, if any, should be discarded. The cost analysis might be truly termed the "barometer" of management. The Monthly Statement of Profit and Loss as shown in Fig. 21, provides a representation of the month's actual profit or loss, with full allowance for part shipment values, and this statement is, in its nature, more accurate than a similar one drawn from the general books. The Monthly Idleness Chart shows at a glance, what expense has been incurred through idleness, and for what causes.

In drawing to a close this series on the small factory, the writer would pause to express a hope that what seems to be the "lesson" of the 1921-1922 depression has been rendered clear, and that the advantages to the small factory of enlightened management, and the risk incidental to its absence, have both been sufficiently emphasized. The benefits to be derived are so obvious as to make it seem remarkable that industry should ever have been without them.

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[6] See MANAGEMENT AND ADMINISTRATION for November 1923, p. 593.

[7] See MANAGEMENT AND ADMINISTRATION for February 1924, p. 161; March 1924, p. 365; April 1924, p. 431; May 1924, p. 567; June 1924, p. 683.

[8] See MANAGEMENT AND ADMINISTRATION for June 1924, p. 683.

[9] See MANAGEMENT AND ADMINISTRATION for November 1923, pp. 596 and 597.

Packing and Shipping Oil and Lubricants

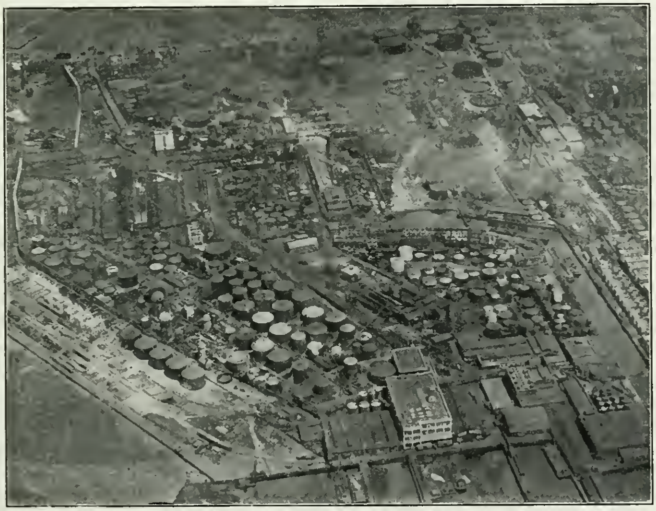
Methods in Use at the Tide Water Oil Company

By J. B. EDWARDS

General Manager, Bayonne Refinery, Tide Water Oil Company

Index Number
658.788:665 Shipping oil
658.78844 Containers

HANDLING of materials is a highly important phase of oil refinery operation because it, above all other branches of the work, marks the line between profit and loss. Between the cost of producing oil from the wells and selling the finished product under competitive prices lies the cost of manufacturing, which determines the margin of profit, and in which mechanical methods are imperative for economy.



Courtesy of Fairchild Aerial Camera Corporation

FIG. 1 AIRPLANE VIEW OF TIDE WATER OIL REFINERY AT BAYONNE, N. J.

The products of the Tide Water Oil Company are over 350 in number and include crude oil, kerosene, gasoline, and intermediate grades; lubricating oils of many different compositions for a wide variety of purposes; and all the ordinary and special greases required to meet the entire extent of industrial needs.

Virgin oil is obtained from three main sources. Much of it comes from Illinois through trunk pipe lines. A finer grade is obtained from Pennsylvania where the company owns or leases over 17,000 wells. About 3,000 miles of pipe lines have been laid to tap this latter source and convey the oil to Bayonne, and 950 miles of telegraph and telephone lines are required to direct its handling. Twenty pumping stations maintain uniform flow on the Illinois and Pennsylvania lines, and from 13,000 to 15,000 barrels of crude oil are delivered every day through the two systems.

A third source of supply is the California field, from which the oil is shipped in tank steamers, as the cost of a transcontinental pipe line would be prohibitive. These steamers dock at the Bayonne refinery and the oil is pumped, at the rate of 5,000 barrels per hr., into one or more of the 600 steel tanks, aggregating a capacity of 3,500,000 barrels of raw and finished products. Some of these tanks are shown in Fig. 1.

The yard railroad to handle incoming materials and outgoing products, except those entering and leaving the plant by water routes, consists of 10 miles of standard-gage track. Five switch engines are used in handling cars, and three locomotive cranes are employed to unload and load various items of freight coming in by railroad.

In the refining process 52 stills are required for the first distillation, and 60 other stills are used in making the finished products. Handling of the oil between tanks and stills is essentially a combination of pumping and gravity discharge through pipe lines controlled by valves according to the special needs at the point in question. Labor involved is confined merely to control of flow, and the attention and operation which are incident to the careful conducting of refining processes.

Oils and greases are packed and shipped in barrels, and in cans of various shapes and sizes. Bulk shipments are also made in tank cars and in tank steamers. The materials handling features in the making and filling of the containers will be taken up in order.

Oak Barrels

Barrel heading is received paired, and in the round, all ready for assembling with the staves. It is unloaded from the box cars on a siding by the storage buildings, and is carried by roller conveyors to the racks, where it is stored on edge for economy of room. Sections are added to the conveyor, as needed, to deliver the heading to remote points. From storage it is conveyed to the adjacent barrel department for use.

Staves are purchased in a semi-finished state, 57,000 being used each day. Those which have been kiln-dried and jointed are removed under cover from box cars onto semi-trailers, which are drawn by electric lift-trucks to the storage-rooms, and unloaded. Here they are kept until wanted for assembly, when they are trucked by the same method to the assembly floor. It is estimated that the use of each electric truck eliminates 3 laborers formerly engaged in this work.

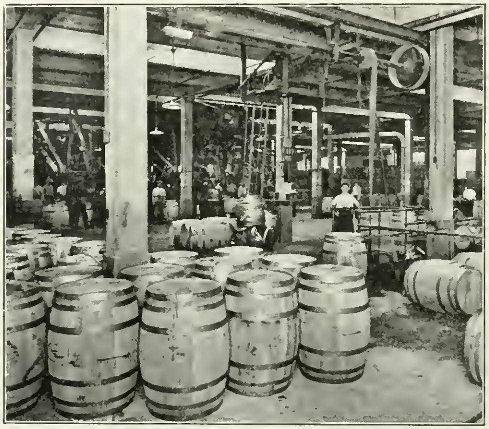


FIG. 2 VIEW OF BARREL-MAKING DEPARTMENT

Green staves are unloaded outdoors onto long steel railroad trucks specially constructed to hold the material during the drying process, and the staves are packed to allow for air circulation. On each truck is noted the order number, shipper's name, number of the railroad car delivering the material, and other data, so that the staves can be identified when necessary. A card is made out for each truck and filed in the office of the barrel factory. When the staves are used a notification is given the office and the corresponding cards are withdrawn and recorded on the books. This system provides a perpetual inventory, and at the same time makes possible the ready adjustment of difference on matters of quality that may arise with the maker of the staves.

The large storage yard for green staves is served by a series of 4 parallel standard-gage transfer tracks leading off from the main yard railroad. Between these transfer tracks, and at right angles to them, are elevated rails on which to run the stave trucks for storage while the lumber is being aid-dried. Transfer cars are provided to carry the loaded stave trucks from box cars to storage, and from storage to the drying ovens for final treatment. Movable rail bridges are used to span the gap between the cars and the storage tracks when trucks are to be run on or off of the storage spaces.

The steamheated drying ovens are equipped with tracks, and the stave trucks are run off of transfer cars directly into the ovens. When the drying process is completed the trucks are run out at the opposite end of the ovens on tracks leading directly into the barrel factory. Here they are unloaded at machines for the first manufacturing process.

One side of each stave as received is curved to form the bilge or wide diameter of the barrel. The opposite side is cut to a corresponding shape on machines in the first step of barrel-making. Knives set in the side of a large revolving disc make the cut in one operation, and the trimmed staves are stacked directly on trucks as completed by the operator. They are then moved a short distance to the assembly floor where they are unloaded on end.

A man places a heavy wrought iron assembly hoop, of the size of the chime or barrel end, and a frame, on the floor and fits staves into them alternating wide and narrow staves until the complete circle is formed. One end of the barrel is left free. The "raiser" then inverts the unit, and removes the frame for use again. A second man throws on a bilge assembly hoop to retain the staves about quarter-way up and puts the barrel on a chain-conveyor which slowly carries it through a steaming oven. A mixture of live and exhaust steam, a larger percentage of the latter when the lumber is particularly dry, makes the staves pliable.

As the barrels come out of the oven at the far end, they are inverted again to bring the loose ends up, and set on a bed plate. A wire cable is thrown around the staves, drawing them up tightly so that an assembly hoop will fit over the chime. The bilge hoop falls off in the process and is kicked into a conveyor which takes it back to the first assembly point for re-use.

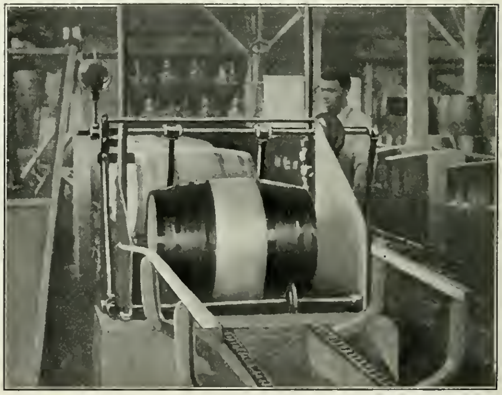


FIG. 3 MECHANICAL CONVEYOR AND BARREL PAINTER

The barrels, with two chime hoops on each, are set on a gravity conveyor and carried to the next room where each is baked over a gas oven. When sufficiently dry they are tightened by pressing the chime hoops on further, and two bilge assembly hoops are fitted. The barrels are then rolled over to an automatic trussing machine, then under a drill which bores a bung hole, and then through a croze machine, in which the chimes, with recesses for the heads, are cut at both ends in one operation. Previously this was done in two steps, involving handling. Combination of work and elimination of labor has raised the output to 250 per cent of the former rate for each machine.

As the barrels leave the croze machine the chime hoops are automatically removed. These hoops fall into chain-conveyors on each side of the machine. One conveyor leads to the first assembly point where the original chime hoop is put on, and the other conveyor takes hoops to the far end of the steaming ovens where the second chime hoop is fitted. After crozing, each barrel is thoroughly brushed inside by a revolving wire brush operating vertically in and out of the barrel. The dust and other foreign substance is carried out by an exhaust system which serves the entire barrel plant.

The barrels are now ready to receive their heads. This is a hand operation and is done by driving a small spike into each head to pick it up, and then forcing the head in place with a hammer. A band iron hoop is then put on the chime. At an adjacent machine the opposite chime band-hoop is pressed on. The bilge assembly hoops are forced off in the next operation, and delivered by chain-conveyor back to the first machine operation. After this the bilge band-iron hoops are driven by machine on the barrel. Finally, quarter-hoops are driven on over each end by a similar process. Fig. 2 is a view of the barrel department with assembled barrels in the foreground.

Hoops for barrels are made of band-iron which comes in bundles cut to width and approximate length. These bundles are stenciled for identification, and card records are kept of them in the office, in the same manner as followed for staves. A total of 17,000 lb. of hoop iron is used each day.

Bands are fed to a machine which cuts them to length and punches two rivet holes on each end. The machine then curls the hoop to shape and ejects it onto a frame. Bundles of these hoops collect on the frames and are then delivered to an adjoining riveting machine where hopper-fed rivets are put in. The hoops are next automatically conveyed through forming machines which stretch one side to make the hoops fit the shape of the barrels. Chain-conveyors lift the hoops and discharge them directly on uprights mounted on trucks. The trucks are moved to the barrel assembly floor without any rehandling of hoops, and are unloaded as needed for use on the barrels.

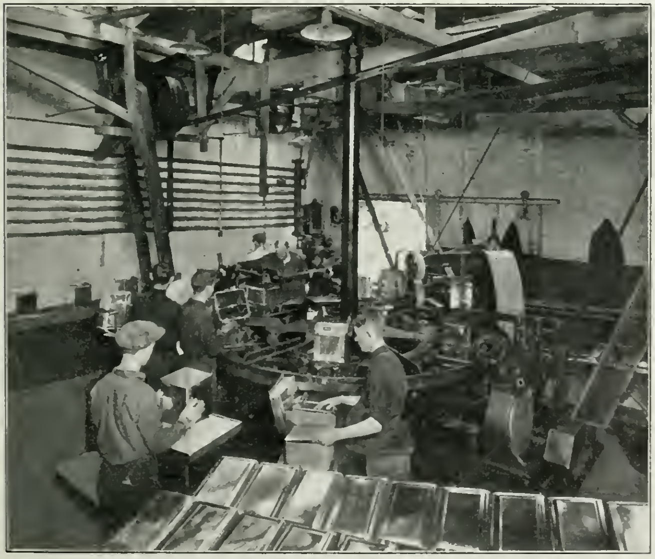


FIG. 4 ASSEMBLING 5-GALLON CANS BY MACHINERY
Conveyor system in background.

In order to seal the joints completely after the barrels are assembled, they are rolled to an elevated gluing and testing machine. Here 2 to 3 gallons of hot glue are run in from a filling machine and temporary iron bungs are fitted. The barrels then roll down to the floor on skids which are set to toss them from side to side to throw the glue into all pores and crevices. A man at the foot of the skids up-ends the barrels in order to coat the heads with the glue. He takes out the bungs from the barrels and throws these bungs into a conveyor which takes them back to the glue-filling station.

The barrels are carried on a slow-moving chain-conveyor, bung hole down for drainage, back past the gluing machine to the end of the drainage skids where they are inspected. Those which show a defect are repaired. Finally, they are carried up in a barrel elevator to a high, enclosed, overhead, gravity conveyor. Through this they travel about 850 ft. to the storage building where they are allowed to season. The output of barrels is 3,000 per day, and, in addition, 1,000 kegs are produced by similar processes.

When required for use and after the hoops are redriven by hand where necessary, the barrels are elevated to a second overhead gravity conveyor, and travel 2200 ft. through the yard to a room in the filling building to be tightened and painted. Here hoops are redriven and barrels are reglued and dried on a conveyor.

At the end of the conveyor a man shifts the barrels to a second conveyor system, parallel to the gluing outfit, and they travel down the room again into a painting machine. As each one comes along the operator throws a lever which presses a brush against the entire length of the barrel. The machine rotates it while the brush applies the paint. (See Fig. 3). When coated, the barrel is ejected and is conveyed past a man who paints one head. At the end of the chain-conveyor barrels are discharged on a cross-conveyor, which, in turn, delivers them to another system paralleling the painting conveyor. While traveling back up the room the barrels are painted on the second head by the same man who painted the first head.

During the travel the paint dries so that the barrels can be handled. The barrels are then stacked and the glue is allowed to set 48 hr. before they are ready for filling. After this they are weighed empty on a platform scale and rolled by gravity to the fillers. They are filled—with regular oils, ten at a time—bunged, weighed, stenciled with gross weight and shipping markings, and then they roll down a long inclined skid to the side of the steam-

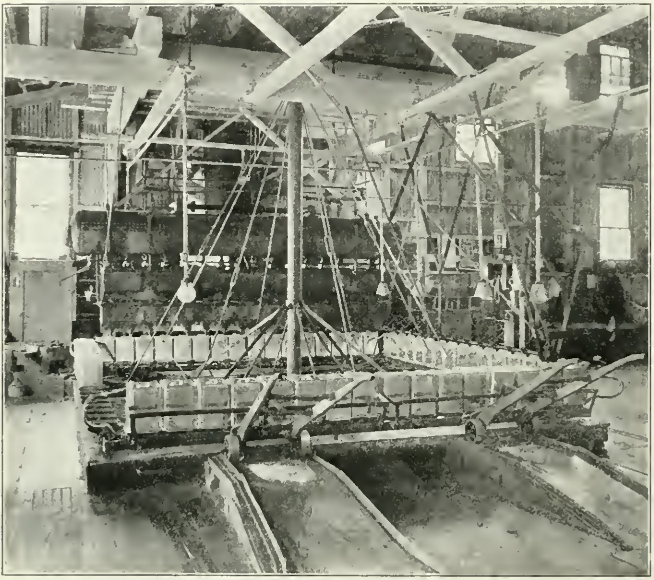


FIG. 5 FILLING AND SEALING 5-GALLON CANS OF OIL

Cans delivered by conveyor and removed by special trucks shown in background.

ship or onto a lighter. Practically all handling is mechanical.

Barrels for lubricating oils and greases are filled by gravity from stills and handled the same way.

Some oil is shipped in steel drums of 15, 30, and 55 gal. capacity. These are bought outside and arrive usually by railroad. They are rolled into the filling rooms, which are adjacent to the docks, and are filled, weighed, stenciled, and shipped the same as barrels.

Loading on steamers is done by men in the employ of the steamship company and is accomplished by slings and hoists on the vessels.

Making of Cans and Pails

Cans are made of tinned sheet metal either plain or lithographed. Kerosene and gasoline are shipped usually in plain 5-gallon cans. Lubricating oils are put in 1- and 5-gallon oblong cans. Greases are packed in round cans holding 1, 5, 10, and 25 lb. respectively.

Metal for cans, of which 80,000 lb. are used daily, is received in box cars, packed in small crates. It is unloaded in a storage-room adjoining the can factory. Three floors of the can building are used for making 5-gallon oblong cans, of which 32,000 are produced daily. In another building the caps, handles, spouts, small oblong cans, and round grease cans are made.

The first operation in making standard 5-gallon cans is to square or cut and trim the sides of the flat sheet. This is done on shearing presses. Two pieces are used in forming the sides of each can.

The second operation consists of forming the seams on what are to be the longitudinal joints of the cans. The third machine indents the sides for strength and forms the sheet into the shape of half a can.

Tops for the cans are cut to size on a press and the filling and discharge hole is punched. This operation also turns the edges for seaming and stamps the company's name, in raised letters. The next machine is rigged to solder on the handles. One operator places stamped handles in the proper position as the conveyor carries the covers by. Clamps on the machines hold them in place, and the can tops pass over gas flames while a second operator applies solder. The clamps lift as the covers reach the far end. Another operator removes the tops and they are trucked over to the assembly machines.

Bottoms are punched and turned up on the edges in the same manner as can tops. They are then trucked to the assembly floor.

In assembling cans, first the two longitudinal seams are fastened, or horned. Then the cans are put on a second machine where tops and bottoms are attached by automatic methods. Finally, an operator removes

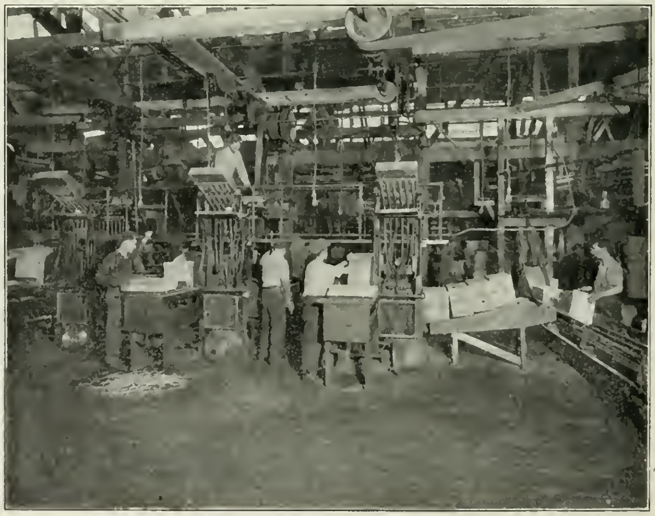


FIG. 6 WAUTERS' AUTOMATIC BOX-MAKING MACHINE

Assembled boxes are taken by conveyor to the packing department.

the assembled cans and puts them on a chain-conveyor which carries them to the third floor. The can-making machine is served by 6 unskilled workmen, and is shown in Fig. 4.

On the second and third floors the conveyors carry the cans through the soldering processes. First the 2 longitudinal seams are sealed and then, in turn, the 4 top and 4 bottom edges. In each case the joint passes, first, through an acid trough for cleaning and fluxing, then through the hot trough of molten solder, next through water to neutralize any remaining acid, and finally past revolving brushes which remove excess solder. During the entire process the conveyor does all the handling, turning, and inverting of cans by means of guides, to bring each edge into contact with the soldering outfit.

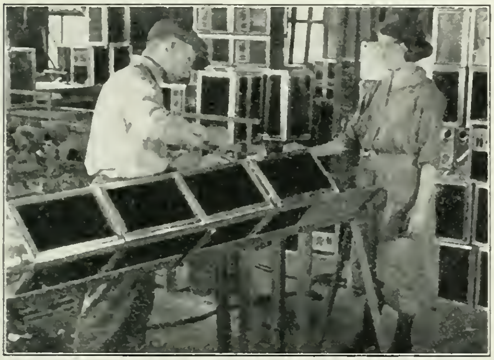


FIG. 7 SOLDERING LITHOGRAPHED CANS FOR LUBRICANTS

At the end of the conveyor system completed cans are inspected for any flaws in formation or sealing, and then are stacked in storage, or else sent directly down chutes and placed in the filling stations on the first floor. The filling stations are composed of 16 small overhead tanks each holding 5 gallons and mounted in a row on a scale balance. The operator opens the control valve and allows enough oil to run into the tanks to float the balance arm. He then shuts off the inlet valve and opens the discharge valves which let the oil into the cans. (See Fig. 5).

The cans are on one side of a large four-sided frame. As each lot of cans is filled the frame is revolved through 90 deg., bringing the cans around to 3 men who put on the sealing caps and solder them in place. At the next quarter turn the cans are removed by 2 special hand-operated lift-trucks, each of which picks up 8 cans at once and is then run by the operator across the room, where, by elevating the handles of the truck, the cans are deposited on the floor. After they have been inspected for leaks, they are put into the shipping cases traveling on a conveyor and taken to the lid nailing machine. The use of conveyors for this purpose eliminates four truckers.

The cases are delivered by conveyor from the box department, and the handling operations involved in making them will be described later. Tops are nailed by machine in one operation on the boxes, and to detect leaks they are placed upside down on a chain-conveyor which carries them overhead, down the building along the dock. If the tops of any cans leak, oil stains show on the cases. Any leaking cans are repaired when they reach the dock. The cases then proceed on the conveyor to a chute delivering them to a platform from which they are stacked on hand-trucks and wheeled a short distance to the steamship. Loading on the vessel is done by sling and hoist, and is in charge of the transportation company.

Boxes for the 5-gallon cans are turned out at the rate of 16,000 per day. This output requires 96,000 bd. ft. of lumber, or a total of 30,000,000 bd. ft. a year. Box shooks, cut to size, are received in railroad cars and are piled in storage. As needed, they are transported on large narrow-gage trucks to the factory.

The first operation is that of printing the boxes with the name, trade-mark, and quantity of oil to be packed in the cases. A cylinder press does this work, turning out the printed lumber at the rate of about 4,000 pieces an hr. The boxes are next assembled.

Formerly 6 single nailing machines attended by 6 skilled workmen and 6 helpers were used in assembling the boxes. The Wauters automatic box-making machine, Fig. 6, designed and built by the superintendent of the department, now performs all operations and turns out boxes, complete except for lids, at the rate of 1,000 per hr. Five unskilled workmen, supervised by a foreman, feed in the ends and sides at the proper points and supply nails to the hoppers. As the boxes come along the conveyor from the machine, an inspector removes any which show faulty nailing due to knots in the lumber. The rest are carried up an elevating conveyor and overhead through the yard to the filling building, where the filled cans are put in, covers are nailed on, and they go to the steamer for shipment.

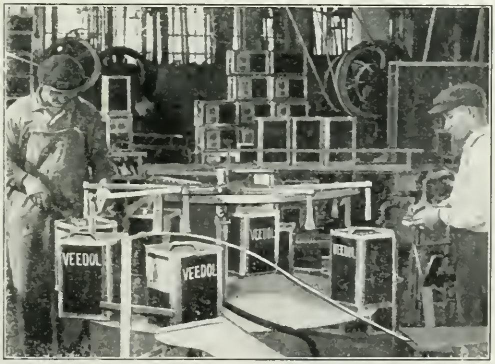


FIG. 8 SOLDERING HANDLES ON CANS

One- and 5-gallon lithographed cans for lubricating oils, and all of the grease pails, which are also lithographed, are manufactured on the third floor of the Veedol Oil and Grease Compound building. The material is carried from the storage-room on trucks to the freight elevator and up to the fabricating machines.

For rectangular cans the sides are first trimmed, cut, and seamed on what are to be the longitudinal joints. Covers and bottoms have meanwhile been cut and flanged on adjacent machines. When the sides of the cans have been jointed and horned the bottoms and tops are put on in a machine in two separate operations. Soldering of joints is done by hand with irons heated in gas furnaces. (See Fig. 7). Automatic soldering methods used for the 5-gal. plain cans are not applicable because of the discoloration which would result to the lithographing. Finally, handles are soldered on (See Fig. 8), and the cans are delivered to a testing machine, where compressed air is applied under water and leaks are detected by the flow of bubbles from any open joints. Handling is mostly by conveyor.

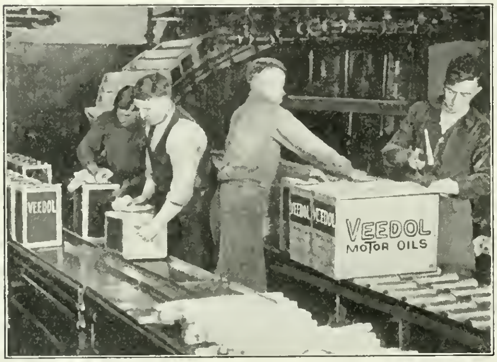


FIG. 9 PACKING CANS IN CASES WHICH ARRIVE ON CONVEYORS

Manufacture of pails for grease is very similar to that of cans, except that the pails are round. Trimmed sheets are seamed and rolled to shape on one machine and are carried by conveyor to the horning operation which fastens the longitudinal joint. Bottoms and rings forming the top cover, into which later a large cap is fitted, are assembled on the next machine. Top and bottom joints are soldered by rolling through molten metal, while longitudinal joints are soldered by hand operation.

The pails next pass to workmen who lay a semicircular, copper-coated, steel wire handle on each, the sides of the pail retaining the handle in place. Over the two bent ends of each handle a metal strip, shaped to form an eye for the wire, is placed. Hand-soldering fastens these handle clips in place. Conveyors have carried them from operation to operation after the forming of the sides has been done. Finished pails are tied in bundles and conveyed to the grease department on the first floor for filling. The empty container storage is located on the second floor and all filling is done on the first floor.

On account of the varying size requirements of cases for lubricating oil, and the impracticability of constructing a universal automatic box-making machine, the manufacture of boxes in this department is done by means of individual adjustable nailing machines, run in series by 3 operators. The finished boxes are placed on conveyors and carried into a storage department on the second floor.

As they are needed, boxes and cans are sent down chutes to the filling floor below. The cans are delivered to the filling machines, which are connected by pipes with the storage tanks where the lubricating oils are prepared. When filled the cans are carried by conveyors past men who place the assembled screw caps on and solder them in place. The cans then are conveyed to the chute down which boxes arrive. (See Fig. 9). Cans are placed in the cases, strips of wood are inserted, the cover is nailed on by machine, and the cans are put, upside down, on one of the lines of gravity conveyors leading to the shipping floor. The function of the wooden strips is to protect the handles and spouts on the cans when cases are inverted. Cases are turned over so that any leaks in the top of the cans will show up at once and can be repaired.

On the conveyors cases are wirebound at the middle with a single wire. They are then stenciled for shipment.

If lighters are at the dock, sections of gravity conveyor are run out and the cases travel directly into the lighters as shown in Fig. 10. If no vessels are at the dock the cases are lifted from the conveyor and stacked nearby, to be put back on the conveyor and sent to the boat when one arrives.

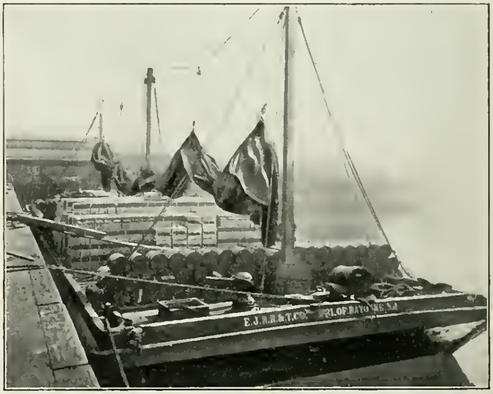


FIG. 10 LOADING LIGHTER BY MEANS OF GRAVITY CONVEYOR

The handling equipment employed throughout the manufacture, filling, and shipping of package products includes hand and electric trucks, storage and transfer cars, racks, roller-conveyors, chain-conveyors of many kinds, chutes, skids, inverting mechanisms, barrel elevators, freight elevators, and many special devices on automatic machines, such as those used in barrel painting, box- and can-making, and soldering of 5-gallon cans.

Little in the way of hand methods remains. Most of the handling of materials is done by mechanical methods, and hand-trucking is limited mainly to storerooms. The use of equipment has brought about savings in the cost of production running up to many thousands annually, and it would be impossible to operate successfully under present-day conditions without the economy in labor and expense which such mechanical devices assure.

Practical Methods for Minimizing Waste

Prevention and Salvage of Waste at Westinghouse

By C. B. AUEL

Manager, Employee's Service Department, Westinghouse Electric and Mfg. Co.

CONSIDERABLE waste may be eliminated by simply doing things in a little better time than has been the custom in the past. Disregarding improvements leading to a lessening of the time required in manufacturing operations and discussing materials only, if these can be more closely checked as to the amounts on hand and required, and if stocks can be replenished in shorter time than previously was taken, savings in material investment may be effected. Even an occasional rechecking of the travel of materials through a plant, and a rerouting of them in consequence, may in itself be the means of shortening the time required to turn out a completed product, thus reducing the amount of material necessary to keep on hand.

It is therefore worth while to outline some of the things which may be done toward this desirable end.

Stores Stocks

The control of stock, raw and finished, is at no time easy, and the more diversified the line of finished product, the more difficult to control. Most schemes of control are based more or less upon past performance, and, if the demand for a product has been consistently steady over a sufficiently long period, a fair control of finished stock can be effected. Owing, however, to the lack of standardization in this country, of which mention has already been made,[1] it is quite the exception to find a product that has been standard for any reasonable length of time, so that with the ever-varying cycles in volume of trade to which this country is subject, to attempt to judge the future by the past and to arrange stocks accordingly on this basis is exceedingly venturesome.

A line of finished products sometimes may be dissected into its elements and a comparison then made of these elements, to determine if a sufficient repetition of the same items occurs to warrant the stocking of common parts. Where this eminently desirable condition is found to exist, stock parts can be built up within moderation during a period of business depression, and drawn upon during a peak of good business. Such a situation may be said to approach the ideal as costs, especially those of material, will be lower than at other times, labor is afforded more nearly uniform employment, and a plant can be run at maximum capacity.

In general, a survey of raw and semi-finished stores materials of any manufacturing concern will usually warrant their division into two classes—standard, and provisional or special.

Index Number
658.78 Material control.
Storing

Items belonging to the former class can, to some extent, especially if falling within the category of commercial or manufacturers' standards, have fairly permanent maximum and minimum quantities or limits set on stocks to keep on hand. For example, if these limits were 100 and 20 respectively, then when the quantity on hand of any item was reduced to the lower limit, it would be proper to enter an order on the purchasing department or on the factory itself to bring it up to the higher limit. The availables are only determined after a careful study of the factors involved.

Items classed as provisional or special, require even more study in reordering than do standard items, and routine methods are not permissible. In fact too much care cannot be given to such items, and their reordering should be the result of the best judgment of all departments combined. The engineering department should go on record as to whether or not changes in design are contemplated in the immediate future; the sales department should furnish estimates as to their expected sales for a given period; the purchasing department should advise on the trend in market conditions, both as to prices and deliveries; and the manufacturing department should advise its requirements for orders already on hand.

If changes in design are contemplated for any reason, then an inventory of all stocks involved, on hand as well as purchased but not delivered, should be taken to determine just when the changes can be introduced to the best advantage and with minimum waste. A study of this kind, if thoroughly made, should also take into account not only new tools, equipment, and floor space, but the disposition of existing tools and equipment. Must they still continue to be held for supply parts; can they be used on other work; or should they be written off wholly or in part; and, if this last mentioned, what salvage values are likely to be obtained? All of these features should first be weighed against the advantages of the changes proposed before the time for the change is determined.

Record of Stocks

Various methods are in use for the actual keeping of records of stocks from the simple one of listing in a card, Fig. 1, attached to the storage bin, which shows the item, the kind of stock, the amount over and above requirements for orders on hand, etc., to the more elaborate loose-leaf ledger sheets, Fig. 2.

A complete physical inventory of all stocks should be taken at intervals as a check. After the actual and the recorded quantities have been brought into reconcilement, each item should be scrutinized by the stockman from the standpoint of its inactivity or obsolescence. Experience has shown that a step of this kind will invariably pay for itself, notwithstanding every endeavor may have been made to carry out the several plans outlined before[2] to prevent the accumulation of inactive and obsolete materials. All items that are obsolete as well as those tending toward obsolescence (slow-moving, inactive, or excessive) should be referred to some individual or department created, if necessary, for the sole purpose of making suitable disposition of, or otherwise salvaging such materials. A department of this kind may be appropriately called the salvaging department.

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[1] A preceding article appeared in MANAGEMENT AND ADMINISTRATION for June 1924, p. 669.

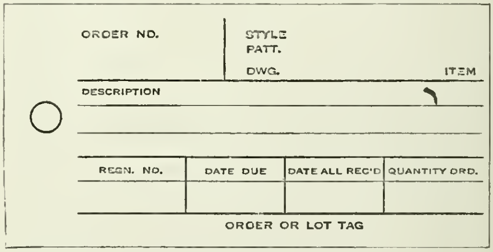
In the meantime all such items should be depreciated automatically, in accordance with some prearranged plan, say 10, 30 and 40 per cent, depending upon the length of time they have been on hand or the degree of obsolescence. For example, if a review of stocks was being made for the first time and an item was seen to have been totally inactive, Fig. 3, or very slow-moving for the preceding twelve months, with an excess quantity on hand, it would be depreciated 10 per cent; if, on the second review, it still continued to be on hand, a further depreciation of 30 per cent would be made, while if it continued inactive for a third twelve-month period, it would be depreciated a further 40 per cent and transferred to the obsolete class. If no disposition was effected by the salvaging department within a final six months, the item would be not only completely written off, less salvage value, but scrapped.

Work-in-Progress

Materials may become inactive from any of several causes. The orders on which they were being used may have had "stops" placed on them, or they may have been reduced or canceled, or else modifications in design may have been made. Any materials thus involved and regularly carried in stock, and which have not had work done upon them, can usually be credited back to the storeroom from which originally drawn. However, when such materials are not regularly carried in stock, or when they are special or have become obsolete, or when they have been worked upon and changed from their original or raw condition, then their economical disposition becomes an exceedingly difficult problem. If an order has progressed sufficiently far toward a finished state, it may sometimes be the part of wisdom to complete it, provided the prospect of a sale to some customer, other than the original one, appears at all favorable to the sales department. If, on the other hand, the work has not advanced very far or is quite special, some other means of disposition must be effected. This usually consists in resolving the parts back into their elements, and considering each element by itself, as to whether it can then be applied on, or held for some other order; whether it should be scrapped outright, or whether it should be made over into something else even though a certain waste may be encountered. In any event, it is a function of the salvaging department to see that Work-in-Progress is cleared of all surplus or held materials, and Westinghouse has worked out a very efficient plan for so doing.

Quarterly "Cleanup"

Every three months throughout the year, except in the quarter during which the annual inventory occurs, a quarterly "cleanup" takes place involving all manufacturing departments. The actual work of inventory is not arduous and, by putting on sufficient clerical help, it can usually be readily accomplished in the course of a Saturday afternoon. Inventory tags, Fig. 4, are used, the stub being first attached to each item on which disposition is desired, the main part of the tag being forwarded to the salvaging department. The securing of proper disposition then becomes the duty of this department and effort is made to have all of the material represented by the tags disposed of within the three-month period, in order to avoid any duplication of tags in the succeeding "clean-up". When this plan was first put into effect, it was a work of some magnitude, but several "clean-ups" soon reduced it to a very moderate undertaking. Of course, if for any reason, finished material is kept and not disposed of within the three-month period, suitable provision must be made for its storage and Work-in-Progress account duly credited.



ORDER NO.

STYLE
PATT.
DWG.
ITEM

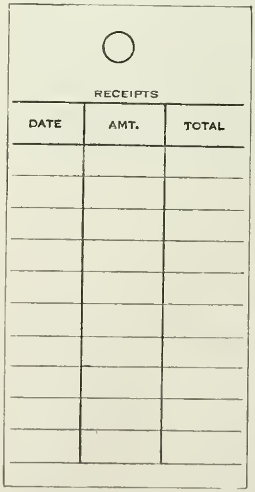
DESCRIPTION

REQN. NO.	DATE DUE	DATE ALL REC'D	QUANTITY ORD.

ORDER OR LOT TAG

(Front)

FIG. 1 SAMPLE STORAGE BIN CARD



RECEIPTS

DATE	AMT.	TOTAL

(Back)

FIG. 1(a) SAMPLE STORAGE BIN CARD

In considering disposition of inactive or obsolete materials, effort should first be made to apply them "at home," as it were, and in their "then" or "as is" condition, for the reason that there will in such case usually be no loss involved, or at least less loss than

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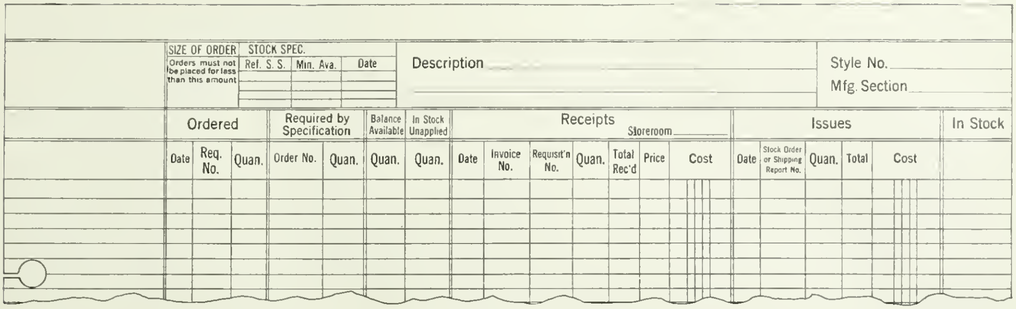
[2] See MANAGEMENT AND ADMINISTRATION for June 1924, p. 669.



SIZE OF ORDER
Orders must not be placed for less than this amount

STOCK SPEC.		
Ref. S. S.	Min. Ava.	Date

Description ______

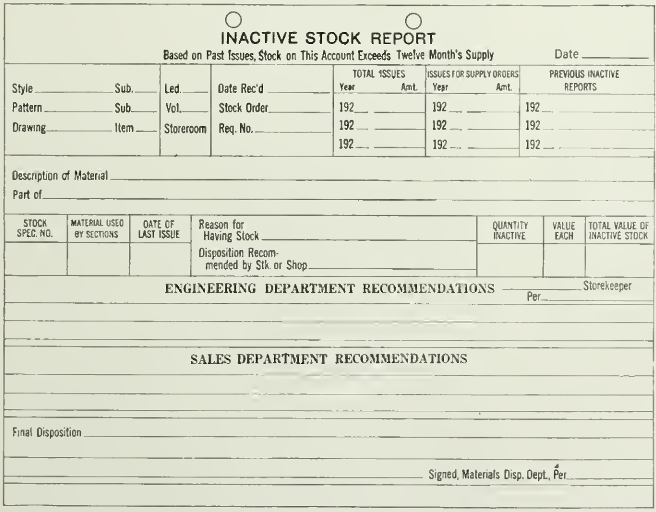
Style No. ______
Mfg. Section ______

	Ordered			Required by Specification		Balance Available	In Stock Unapplied	Receipts Storeroom ______							Issues					In Stock
	Date	Req. No.	Quan.	Order No.	Quan.	Quan.	Quan.	Date	Invoice No.	Requisit'n No.	Quan.	Total Rec'd	Price	Cost	Date	Stock Order or Shipping Report No.	Quan.	Total	Cost	

FIG. 2 LEDGER SHEET STOCK RECORD

if their physical condition requires to be changed, or if they are disposed of by sale, exchange, or credit. Sometimes with the aid of the engineering department one material may be readily substituted for another when, say, the cross-section is the same, but width and thickness differ, or perhaps two sheets of thin material may replace one sheet of twice the thickness; occasionally a design may be changed without altering the performance or departing from the specifications. Failing the application of any material in its original condition, effort should next be made to use it and still "at home," by changing its conditions or shape, even if some loss is incurred thereby. Only after exhausting these possibilities should outside agencies be investigated. A considerable number of these agencies can generally be approached through either the purchasing or the sales department.

In some of the larger industries, the employees themselves serve as customers for certain inactive, surplus, or obsolete products of the factory, as well as of raw materials used, and are only too glad of opportunities to purchase at reduced prices.



○ ○

INACTIVE STOCK REPORT

Based on Past Issues, Stock on This Account Exceeds Twelve Month's Supply Date ______

Style ______ Sub. ______
Pattern ______ Sub. ______
Drawing ______ Item ______

Led. ______
Vol. ______
Storeroom

Date Rec'd ______
Stock Order ______
Req. No. ______

TOTAL ISSUES Year Amt.	ISSUES FOR SUPPLY ORDERS Year Amt.	PREVIOUS INACTIVE REPORTS
192__ ______	192__ ______	192__ ______
192__ ______	192__ ______	192__ ______
192__ ______	192__ ______	192__ ______

Description of Material ______
Part of ______

STOCK SPEC. NO.	MATERIAL USED BY SECTIONS	DATE OF LAST ISSUE	Reason for Having Stock ______ Disposition Recommended by Stk. or Shop ______	QUANTITY INACTIVE	VALUE EACH	TOTAL VALUE OF INACTIVE STOCK

ENGINEERING DEPARTMENT RECOMMENDATIONS ______ Storekeeper
Per ______

SALES DEPARTMENT RECOMMENDATIONS

Final Disposition ______

Signed, Materials Disp. Dept., Per ______

FIG. 3 INACTIVE STOCK REPORT

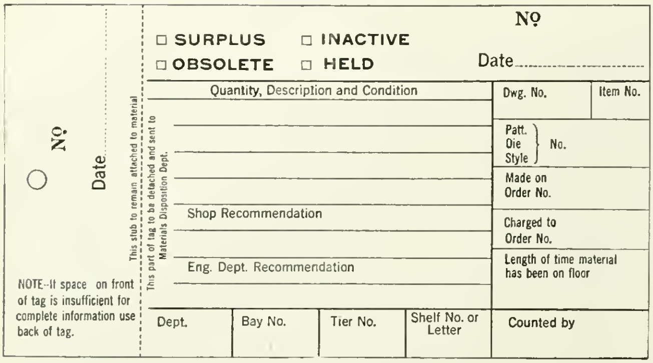
A receiving department may be considered as a temporary storeroom given over to the handling of every kind of material taken into a factory. It is here that all materials must be unloaded and identified; and, if facilities are not available for their immediate removal to stores or manufacturing department, there is opportunity for them to be damaged or to be lost track of, and considerable time is wasted in eventually relocating, and once more identifying them. Automatic trucks will be found to be of the utmost assistance in prompt unloading and removal of incoming materials to destination, and their use cannot be too strongly recommended. It is recorded of one concern, which was limited with respect to space in its receiving department, as a result of which the proper handling of materials was much hampered, that the replacement of hand trucks by the quicker moving automatic trucks enabled the removal of materials to be effected practically as fast as unloaded, so that the congestion was removed entirely.

Storing, Boxing, and Shipping

The storing, boxing, and shipping of stocks in general are not yet being given the attention they deserve. As a result, unnecessary loss is incurred, due to deterioration or damage, or to inability to locate the stocks when wanted. Oftentimes materials, which either absorb moisture or are affected by it, are stored with little regard as to whether or not the location selected is dry or damp.

Readily oxidizable materials are too often stored without a protective coating or wrapping when a little care or locating them away from the vicinity of windows frequently opened would prevent a loss. Sometimes it may even pay to keep small, thin material like sheet steel finished parts in jars to prevent rusting. In the case of finished materials given to tarnishing, a colorless lacquer sprayed on before wrapping will enable the original brightness to be retained.

Materials packed in fiber or paper containers not infrequently are stored directly on the floor, whereas



Nº

Date

○

NOTE—If space on front of tag is insufficient for complete information use back of tag.

This stub to remain attached to material

This part of tag to be detached and sent to Materials Disposition Dept.

Nº

☐ SURPLUS ☐ INACTIVE

☐ OBSOLETE ☐ HELD

Date

Quantity, Description and Condition

Dwg. No.

Item No.

Patt.
Die } No.
Style

Made on Order No.

Shop Recommendation

Charged to Order No.

Eng. Dept. Recommendation

Length of time material has been on floor

Dept.

Bay No.

Tier No.

Shelf No. or Letter

Counted by

FIG. 4 INVENTORY TAG

it is good practice to raise them a few inches to avoid deterioration. The hooks of crane sling chains should not be driven into a box at all if it can be avoided; but, if this cannot be avoided, care should be taken to see that the hooks are made secure in the part of the box best suited to take the strain of the lift. Four arms to a sling chain are to be preferred to two arms.

In moving burlap-wrapped rolls, or other unboxed though wrapped material, it is better not to use baling hooks as otherwise the contents will not infrequently be damaged. Paper and fiber are both subject to inroads from rats and mice, so that a few cats about the storerooms will prove an excellent investment in order to avoid material loss.

Too little care is given many times to the storage of oily or greasy materials such as oiled duck, oily (not dirty) waste or mops, etc. The first mentioned should never be piled in layers over one inch thick, but should have separators spaced at frequent intervals to allow a free circulation of air, thus reducing the likelihood of spontaneous combustion. Oily waste and oily mops, if necessary to be kept at all, should always be stored in metal containers.

Irregular shaped pieces are expected to fit into shelving, etc., with the same facility as boxed material, whereas a little ingenuity in the construction of special shelving will be amply repaid, as Fig. 5. Bar stock of light and medium weight materials can often be stored in vertical instead of the customary horizontal racks, not only more conveniently but with considerable saving in floor space. Painting bar stock either by a full length stripe or across the ends, furnishes a ready means of distinguishing different kinds. This same idea has been carried out with sheet steel by having certain grades, which otherwise could not be told from one another, painted with criss-cross lines at the mill before shipment. If the brief description of the contents of a box or crate which is usually stenciled on it in ink, be given a stroke of shellac, there will be little danger of the description becoming rubbed off.

Castings are sometimes stored in the yards unpainted when a coat of the cheapest kind will save either subsequent total loss or extra machining or labor, in order to remove the scale. When it is known castings will be stored in the open, arrangements may be made with the supplying foundry to set up a tank and drip board, so that dipping or painting may be done even before shipment.

Sawdust, shavings, and excelsior are all too frequently used before being thoroughly dried out, with more or less damage to the contents of the box. For the handling of small part orders, misprint salt bags, used burlap bags and the like will be found of great convenience. By cutting burlap bags into strips, they may also be used for wrapping coils of wire, bars, etc.

Containers satisfactory for one class of material are sometimes used for another class, with bad effect, when a few test packages sent out by freight, express, or parcels post would perhaps have demonstrated their unsuitability. Material or apparatus is sometimes completely boxed when crating or even skids would have been quite sufficient. There are concerns that specialize in the design of shipping boxes, and it may be well worth while to call such engineers into consultation, especially when a standard line of apparatus is being put on the market.

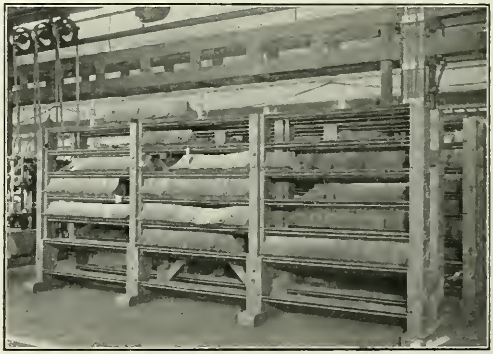


FIG. 5 SPECIAL SHELVING FOR IRREGULAR SHAPED PIECES

In this country, closed freight cars are almost invariably used for the shipment of material or apparatus at all subject to weather conditions whereas in European countries open freight cars are much more largely in evidence, tarpaulins covering the entire car. The hauls are, however, much shorter. Notwithstanding this important difference, it would seem as though open cars should be more largely used over here, especially when a saving can be effected in loading and unloading by their use. One concern makes large shipments of sheet steel in this way and has found the change over its previous method of closed car shipments to be of advantage in every way, even the banding of the sheets into bundles having been eliminated.

Allowances on Office and Factory Supplies, Etc.

Carrying out the idea of limits on stores stocks, wastes may likewise be prevented in small supplies, tools, etc., for the office and factory, by the setting of allowances for the individual employees.

Among these items may be included pencils and pencil-holders, pen and pen-holders, pads, typewriting ribbons, writing and carbon papers, erasers, inks and ink-wells, blotters, towels, both paper and cloth, soap, etc. A similar procedure may likewise be followed in the factory with respect to other items, such as waste, wiping cloths and electric-light bulbs. In the case of small, hand and machine tools, like mallets, hammers, files, saws, chisels, drills, cutters, etc., a simple system of checking may be readily instituted. The Westinghouse system consists in giving to every employee who requires tools a number of brass checks, all bearing the same number and assigning a hook to him with this number, on a properly arranged board. For each tool that he gets from the storeroom he hands in one of these checks. This check is at once placed in the bin or receptacle from which the tool is taken; and, at the same time, a similar check but bearing the designation of the tool is removed from the bin or receptacle and hung upon the employee's hook on the board. At any time it is an easy matter, by referring to the hook assigned to the employee, to determine just what tools he is charged with; and in case it is desired to close his account, it only becomes necessary to remove such checks as may be hanging on his hook, compare them with the returned tools and then place them with the returned tools back in their respective bins or receptacles, taking out at the same time the employee's checks and hanging them upon his hook. Of course it is not customary to charge a workman for the ordinary wear and tear on tools, but rather to hold him responsible for loss due to carelessness. The mere knowledge of this has in itself an effect in reducing wastes of this nature.

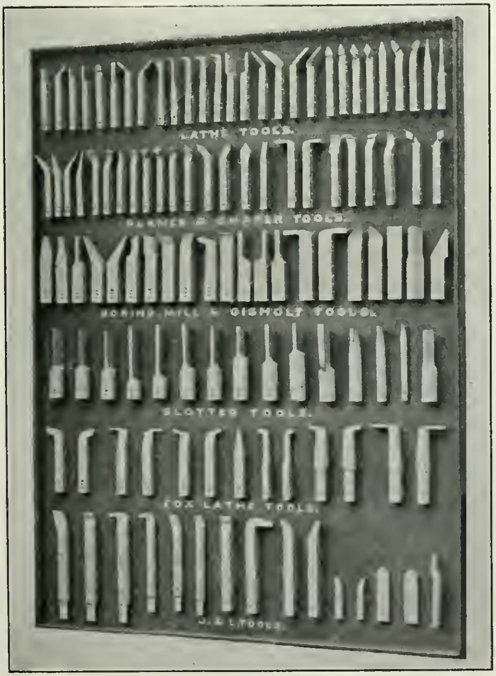


FIG. 6 STANDARD MACHINE TOOLS

Some concerns have instituted the same kind of an inspection of desks, closets, files, etc., throughout the offices, as outlined for the factory under the paragraph entitled "Inspection of Tools and Equipment". It will be proved to be about as necessary a step to take for the offices as it is for the factory, for an accumulation of supplies of all kinds will be found.

Standardization of Cutting Tools and Fixtures

The standardization of small tools, including hand tools, such as hammers, mallets, sledges, tongs, files, and saws, cutting tools for lathes, planers, shapers, and milling machines, as well as the standardization of die and jig parts is something which should not be overlooked in a study of waste prevention, Fig. 6. Aside from savings in increased and uniform production, there are further distinct savings, direct and indirect, to be effected both in making and using standardized tools and parts. In the first place, there is a money-saving effected in the actual purchase of the tools and parts themselves, owing to their being, in any quantity ordered, fewer kinds and sizes; in the second place, there is less storage space required and fewer records to be maintained; in the third place, there is less likelihood of tools and parts becoming inactive and more of an opportunity for working them over into other sizes, as with a standardized plan some of the tools and materials from which they are made can be purchased with this point in mind. For example, wheels for grinding machines can be purchased for the larger sizes and used until they are worn down to certain smaller diameters, when they are then available for the smaller sizes. Solid high speed steel lathe tools, etc., of the larger sizes can be used until worn and ground down to the limit, when they can then be forged out to full length tools of the smaller sizes; and this forging can be repeated and tools provided of smaller and smaller sizes until finally the absolute minimum limit is reached. Even after this, such tool steel could be forged into very small tools suitable for use as teeth in milling cutters and for use with tool-holders, though it would be more economical perhaps to buy tools of this type and sell the remaining steel for scrap. Some concerns have found it advantageous to make welded tools with high speed steel for the cutting ends, and carbon steel for the shanks or butts.

Inspection Department

The inspection department, aside from its regular functions should properly be counted upon to see that the routine is followed in the rejection of defective or spoiled materials, and no such materials or scrap of any kind should be permitted to leave the manufacturing department without first being inspected and labeled with the proper tags, Fig. 7, by the inspection department. In this way a safeguard will be introduced against the premature scrapping of material, more care will be taken by each manufacturing department to see that scrap is not mixed, and all material will be easy of identification, when it arrives at the salvaging department.

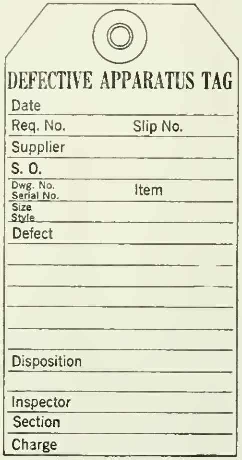
Inspection of Tools and Equipment

A regular inspection of all tools and equipment, especially small tools, used throughout the factory, will prove a most economical undertaking. Although small tools are usually issued to the workmen by check, or in some other manner by which they can be readily traced, nevertheless the average workman is generally loath to turn them back to the toolroom. He prefers to keep them nearby against the possible eventuality arising of his needing one of those same tools again and thus perhaps saving himself a trip to the toolroom. In addition there is a tendency on the part of the average employee, more particularly of the semi-skilled and unskilled, to keep a tool in work long after it has commenced to show signs of wear until it has finally reached a condition where repairs cannot be made and the tool must be scrapped. It is therefore seen to be advisable to institute a systematic plan of gathering in small tools at intervals and no better time can be selected than when the "clean-ups" are made of Work-in-Progress, to which reference has already been made. At such times, each workman should be interviewed personally by the foreman and instructed to take back at once to the toolroom every tool not immediately in use. It needs but a single demonstration in a factory of moderate or even small size, to convince any one, of the great amount of money which is thus uselessly tied up and which until brought to the surface by a plan of this kind constitutes one of those intangible wastes of industry of which there are all too many.

Paradoxical as it sounds, it may at times be a waste to save perfectly good tools, jigs, or fixtures. Most factories sooner or later find themselves in need of additional storage space for such items, and it becomes a serious matter to determine what steps to take under these circumstances. One factory has helped itself materially in the solving of this really difficult problem by making it a general rule to scrap or salvage any tools, patterns, dies, or fixtures which have been superseded or which have become obsolete, or for which no orders requiring their use have been received within five years. It is almost needless to state that this authority is not delegated to any foreman but is vested directly in the shop management.

Power House

From the viewpoint of the salvaging department, the power plant, if the factory produces its own power, should not be overlooked; but should be expected to contribute its own share of savings. Notwithstanding it may be of the most modern design in equipment and arrangement there is still large opportunity for waste by improper maintenance and operation; and skilled help might almost be said to be as much needed in it as in the toolroom. Coal should not necessarily be bought on the basis of analysis alone, but on such analysis in connection with a knowledge of the stoker equipment. Feed water should be kept free from sediment and other impurities and frequent tests should be made to this end. Meters, gages, and other measuring instruments should be calibrated regularly; boiler flues and mud drums should be cleaned as experience indicates, and blowing down the boilers should be resorted to as indicated by water tests. Ash-pits should be carefully watched to see whether or not unburned coal is dropping into them. Clean fires should be maintained always, and drafts and feeds should be properly regulated. Leaks in water, steam, air and gas mains and pipes should be eliminated. Grounds on electrical circuits should be corrected. Quality and quantity of lubricating oils should be studied, and used oils and wiping wastes or rags should be reclaimed and finally burned, and spare parts should be kept constantly on hand. Ashes may prove of value or otherwise, depending upon the location of the factory, whether low-lying ground nearby can be filled or whether cartage must be paid for their removal to some distant point.



DEFECTIVE APPARATUS TAG

Date

Req. No. Slip No.

Supplier

S. O.

Dwg. No. Serial No. Item

Size Style

Defect

Disposition

Inspector

Section

Charge

Fig. 7 Sample Scrap Tag

As showing the vital influence the power plant has on the entire factory, it may be mentioned that even a very moderate drop in voltage, say 10 per cent, will dim the factory illumination by 30 per cent, thus tending to reduce both the output and the earnings of the workers; while a slight reduction in speed of the generators (if AC as they usually are) will correspondingly slow down the speed of the driving motors throughout the entire factory, thus also reducing output.

The power-house inspection should be extended into the factory proper to include the main steam, air, water and gas pipes and the electrical circuits; and, at the places where such power-house inspection ends, a similar inspection on the part of the factory should begin and continue on down to the place of consumption or use.

Not all the ways in which waste may be minimized have been mentioned, but the examples given will be suggestive of others which may be used to advantage. The "prevention" view of material waste is very important. It will be impossible to eliminate waste entirely—a certain amount is unpreventable—but there is, in most plants, much more than is necessary, and in a year's time it means a considerable monetary loss. If plant managers would direct their efforts toward preventing waste rather than toward reclaiming it after wastage occurred, results attained would be much more satisfactory.

(To be concluded in the August issue.)

A Suggestion for a Premium System

By CARL G. BARTH

Consulting Engineer

REPEATEDLY the writer's attention has been called to articles on wage systems that have included a reference to what the authors have named "Barth's system," and this though I have personally never before written anything to lay claim to being the inventor of a wage system of my own. I have always been so unfavorably impressed with the evident desire on the part of numerous efficiency engineers to have their names attached to a wage system of their own, that I have heretofore purposely refrained from bringing my own suggestion to public notice. An additional reason is that many prospective clients in the past, first wrote me to the effect that they contemplated introducing a new system for paying their help, thus betraying that all they were looking for in a Taylor system of Scientific Management was an improved wage system. However, having on two occasions received direct inquiries about the "Barth Wage System," and having recently given up the business of management engineering, I feel that the time has come for me to make an exposition of my suggestion, for that is all that I claim it to be, and to state under what conditions it appears to possess sufficient advantages to recommend itself.

Origin of the Suggestion

The fullest understanding of my suggestion will be obtained by a review of the manner in which it came to me when, several years ago, I made an independent comparative study of the then leading wage system, and more particularly when I compared the Rowan Premium System with the Halsey system, of which the former is an alleged improved modification. Believing that I realized just about what Mr. Rowan tried to accomplish with his modification, but also that his very ingenious formula failed in important respects to accomplish his aim, I attempted to do what he had thus, to the best of my knowledge and belief, failed to achieve.

With this object in view I turned to the original Halsey system and performed the little algebraic maneuver repeated below.

Let: A = time allowed. $P = \frac{1}{2}S$ = premium time.
T = time taken.
$S = A - T$ = time saved. E = total time earnings.

$$\text{Then: } E = T + \frac{1}{2}S = T + \frac{1}{2}(A-T) = \frac{A+T}{2} \ldots\ldots\ldots\ldots\ldots [1]$$

That is, under the Halsey Premium System with a premium set at one-half the time saved, the total earnings are the *algebraic* mean between the time allowed and the time taken. But for small differences between two numbers their *geometric* mean differs but little from their algebraic mean.

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Hence I quite naturally undertook to investigate what kind of a modification of the Halsey system would be obtained by substituting the geometrical for the arithmetical mean of A and T in formula [1], i. e., I tentatively wrote:

$$E = \sqrt{A \times T} \ldots\ldots\ldots\ldots\ldots\ldots\ldots\ldots [2]$$

And as pure luck would have it, formula [2] when plotted, at once appealed to me as giving exactly what I had conjectured Mr. Rowan's aim had been. This will appear from the comparison of the three wage systems referred to in Fig. 1.

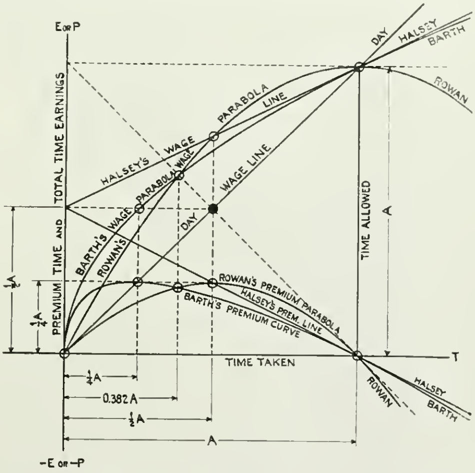

Fig. 1 Comparison of Premiums and of Total Earnings Paid by the Three Premium Systems Discussed

Keeping our eye on the Halsey wage (in time units) line, we see that the Rowan wage parabola, as of course often discussed before, pays higher premiums and total earnings than the former, down to the point at which the time taken is just one-half of the time allowed, at which point it also is a maximum. After that the Rowan premium again falls off, towards *0*, as the time taken theoretically approaches *0*, whereas the Halsey premium approaches more and more to its theoretical maximum of one-half the time allowed.

Evidently, in Mr. Rowan's shop, time allowances were originally merely based on records of past per-

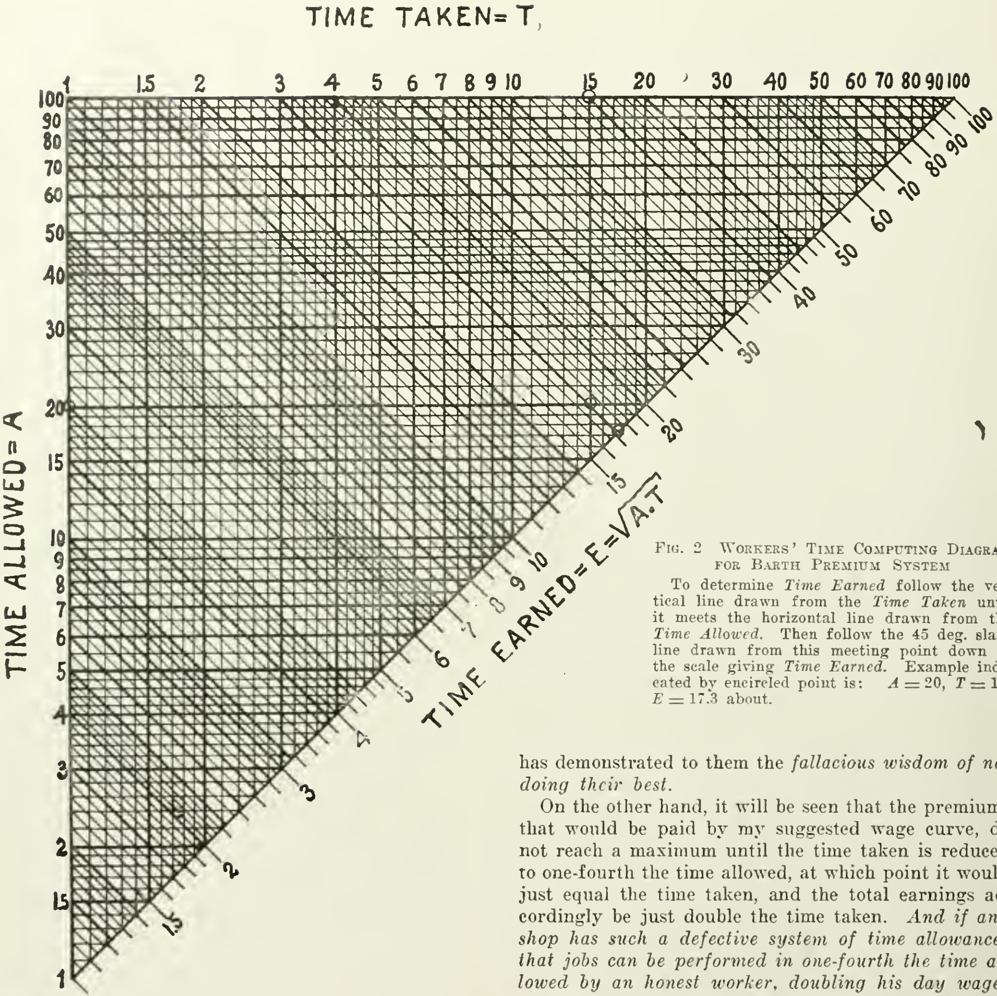

Fig. 2 Workers' Time Computing Diagram for Barth Premium System

To determine *Time Earned* follow the vertical line drawn from the *Time Taken* until it meets the horizontal line drawn from the *Time Allowed.* Then follow the 45 deg. slant line drawn from this meeting point down to the scale giving *Time Earned.* Example indicated by encircled point is: $A = 20$, $T = 15$, $E = 17.3$ about.

formances or were pure guesses which the Halsey Premium System, as elsewhere, had frequently shown up to be entirely too great, so that jobs would be performed in a mere fraction of the time allowed, and pay earnings that in the opinion of the management were unjustifiably high. This defect Mr. Rowan evidently set out to correct, by devising a formula that automatically would reduce the premiums for jobs honestly performed under excessive time allowances, such that the total earnings approached a theoretical maximum of twice the day wages, as the time taken approaches *0.* This might in itself be a pretty good way of handling a condition so unsound, but Mr. Rowan's formula accomplishes this at the expense of paying premiums for fat jobs to workers whose experience with this system has demonstrated to them the *fallacious wisdom of not doing their best.*

On the other hand, it will be seen that the premiums that would be paid by my suggested wage curve, do not reach a maximum until the time taken is reduced to one-fourth the time allowed, at which point it would just equal the time taken, and the total earnings accordingly be just double the time taken. *And if any shop has such a defective system of time allowances that jobs can be performed in one-fourth the time allowed by an honest worker, doubling his day wages should not be begrudged him.*

And here is where I now venture to recommend the use of my suggested wage curve in preference to any other that I know of, in shops that still have no scientific rate setting, or merely such in a crude way, which is still all that the majority of shops have. Also, paralleling satisfactory piece rates, for jobs on which constant practice eventually makes a worker so expert that no kind of time study as now practiced, can set a satisfactory rate for a worker who has reached only a moderate degree of expertness, or who is entirely new at the job.

But as no method of pay should be so complicated that the workers cannot readily compute their earnings on each job, the objection may properly be made that workers as a class do not understand square roots, not to mention being able to extract square roots. However, I know from personal experience with a group of

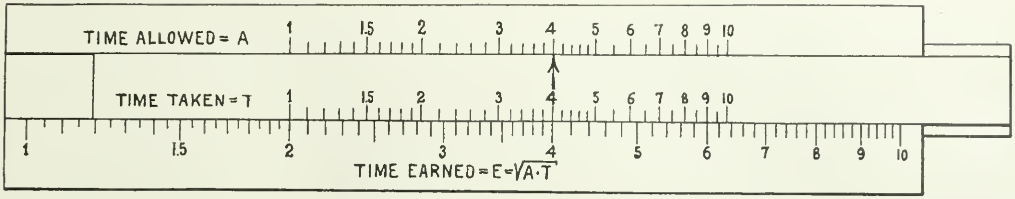

FIG. 3 SLIDE RULE USED FOR COMPUTING WORKERS' TIME

Set arrow to Time Allowed and read Time Earned opposite Time Taken. All figures may be multiplied or divided by 10.

workers whose intelligence was not above the average, that this difficulty can be overcome by furnishing groups of workers, either with a computing diagram made on the principle of the one illustrated in Fig. 2, or with a cheaply constructed slide rule on the order of the one shown in Fig. 3. Either of these means would enable the workers to compute their earnings to a satisfactory degree of accuracy. The mystery to them behind such means, so far from making them objectionable, seems actually to appeal to them.

Trend of Organization in the Clothing Industry

THE breaking up of the men's clothing industry into smaller manufacturing units, away from the large centers of production, though not a new venture, has in the last decade gained considerable impetus. Many factors enter into the consideration of such a move, to insure successful operation, and a few of these will be briefly outlined.

Production Required. The production desired for present sales plans and immediate anticipated expansion is a matter for primary settlement. It cannot be decided independently, however, because it involves such other questions as the time limit in which desired production should be attained, production turnover, and estimated standard cost limits.

Location. The selection of the town in which to locate the business requires the consideration of many essential factors, among which are: the attitude of state and local governments; taxes; population; the attitude of representative citizens toward manufacturing; labor stability, which is directly reflected in quality and quantity of production, good earnings, and low costs, and in many instances has been obtained in towns of 5000 and less; caliber of available labor as to intellect, skill, industry, and thrift; nature of local demands for labor, and rates for local and adjacent labor; working conditions and wage scales for males and females; living costs; transportation facilities for labor; transportation facilities and rates (rail and motor truck) for materials and supplies; light and power facilities and rates, etc.

Plant. In relocating a clothing industry it is usually wise not to impair the liquidness of assets by plant construction or purchase, especially in the temporary absence of a profitable and efficient working unit. Therefore, what are the most favorable rental terms obtainable for accommodations suitable for the manufacturing requirements? What alterations, if any, will be necessary to satisfy the fire insurance underwriters, and what will be insurance rates?

Equipment. All equipment, including machinery, work bins and benches, and receiving and shipping facilities, must be designed and laid out so as to insure minimum handling, efficient routing, and quick dispatch of work.

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Labor. The best results are secured where labor is efficiently selected, assigned, and developed. There are many simple and practical methods for attracting labor. Which of these to use depends on specific conditions.

Supplies. A classified schedule is required showing the standard rate of consumption of all supplies. This limits ordering to only once a week, on a specific day. Minimum amounts are kept on hand, but without causing a shortage otherwise jeopardizing production.

Supervision. The efficiency of the plant reflects the efficiency and co-ordination of the supervisors. The successful plant manager co-operates with his quality and production supervisors. He possesses the ability to select and hold the best labor obtainable, with high attendance averages, low labor turnover, good discipline, contentment, and good earnings; to supervise the handling of expenses, and all labor and production records; and to comprehend the direct relation of his unit, in all its functions, to the general organization.

The efficient foreman is fully informed on all matters relating to quality and production, and has the ability to impart this information to others, and to secure desired results. The assistant foreman is required to possess all the qualities of a foreman, except that he does not exercise full executive functions.

Operating Methods

Production Standards. When questions of location, equipment, and personnel have been settled, production standards are established for each operation, per operator, per unit of time, and for finished units, per plant, per unit of time. Dividing the production processes into representative sections, terminating at important operations, and posting hourly the cumulative production at these points, serves, if the proper spirit is imbued, as an incentive to the operators and foremen to attain or to better standards, effect an even flow of work, and eliminate congestion. Schedules set for daily production requirements are based on standards and vary in accordance with the separate requirements of the individual operations and available labor.

Operation Schedules and Piece Rates. A schedule of operations and tentative piece rates is devised before production is started. Operations should be as large as permissible by the sameness of thread, equipment and skill requirements, and the limits of practicability. Limits of practicability are, in part, governed by the necessity of having units in balance at the various operations, and of maintaining a rapid turnover.

Piece rates are most satisfactory if based on motion and time studies, made by a competent person with the collaboration of the production man and the workers. The worth of time standards is in direct relation to the practicability of the policy followed in establishing them. Piece rates should be set as soon as possible so that production and costs can be efficiently controlled.

Route Sheets and Wage Tickets. A system commonly followed is to have each operator record on a wage ticket, in duplicate, the number of the operation performed, and the finished bundle number and quantity. These entries are checked, periodically, during the day, on batch route sheets; and, when correct, are stamped and passed for the pay-roll. From a master route sheet and the manufacturing order a route sheet is prepared for each separate batch of work, except where it is practical to use it for more than one batch.

Dispatching. Work is dispatched according to considerations of delivery requirements, balances of labor in the various process sections, quantity of units in process, production schedules, models, color of sewing silk, balances of finished parts ahead of assembly operations, etc. Production of parts sufficiently in advance of the needs at assembly operations prevents a stoppage of the flow of work due to part shortages, and permits switching operators of sufficient skill to operations where there is actual or anticipated congestion.

Production and Shop Records Kept

Daily Production Records. Records of production in each manufacturing section, and of work received and shipped are entered daily. From these records production surveys can be quickly made, and the balances of work ahead of production, in process, and awaiting shipment, can be obtained when and as wanted. These figures are totaled and balanced weekly. Inventories may be compiled from the route (and progress) sheets when necessary.

Production and Cost Records. A simple but complete weekly history of the operations of each manufacturing unit is recorded promptly at the control office. It gives the plant working hours, labor attendance percentage, labor turnover, direct and indirect labor employees, total plant production, unit production per 10 man-hours, unit gross cost, totals of actual and estimated gross costs with cumulative difference, and manufacturing burden and direct and indirect labor. (Cumulative average figures of the major items, and a distribution of direct and indirect labor only as is necessary to watch and control major contributing items). Standard ruled sheets are used, with 26 weeks or one-half year to one side. The sequence of the use of lines corresponds with the sequence of calendar weeks. With these sheets, it is possible to make ready comparison of the various items from week to week in one plant or between plants. With standard time and piece rates, more accurate comparisons of costs, production, and labor statistics are possible.

Weekly Shop Report. From the production and cost records, each shop receives promptly a weekly report of its labor attendance percentage and labor turnover, production per 10 direct man-hours, cumulative direct labor wage losses, and the tendency of gross cost, using for the latter a figure indicating direct ratio of fluctuation but not revealing the actual cost.

Control and Labor Records

General Control Records. The central office keeps direct, effective, and immediate control on the progress of each batch of work through the manufacturing divisions, and on the balances of each manufacturing division. Whenever possible, this information is compiled from consolidated reports serving more than one function, thereby eliminating superfluous work and expediting the preparation of reports.

Labor Records. An individual record is kept of each employee's weekly status for the current year. This is done on a 10½ by 7½ in. loose-leaf form, with allowances for 26 weeks on each side. General information pertaining to the employee is recorded at the top of the sheet. Specific information, as follows, is entered below: date, pay basis and rate, times tardy, actual hours worked, attendance percentage, operation numbers performed, distribution of earnings—as piecework, non piece-work direct, indirect, bonus, allowances, losses and gains, weekly and yearly cumulative wages, and cumulative losses and gains. The keeping of these records requires but little time, as they are posted directly from pay-roll summary sheets. They are indispensable as labor controls, which require immediately available facts about each employee, whether engaged at direct or indirect labor.

The above outline is a statement of what the clothing industry is endeavoring to accomplish in its efforts to analyze, organize, and standardize all functions connected with plant operation and the efficient selection, assignment, and development of personnel. When this work has been extensively carried out and the square deal in industrial relations is more firmly established on both sides, then high quality, large production, low costs, high earnings, and labor contentment will be more possible of attainment.

In this industry, as in others, many manufacturing problems are the result of fundamentally wrong policies rather than a need for the installation of additional systems. Bad plant functioning cannot be improved by system when the real need is a change of attack or of policy. Efficient methods and systems are auxiliaries necessary to constructive policies but will not of themselves make a poor management policy good.

Management Factors in the Shoe Industry

Methods Which Solve Marketing and Manufacturing Problems

By SANFORD E. THOMPSON and WILLARD E. FREELAND

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THE production of boots and shoes in the United States has been accelerating for many years at a pace faster than the growth of population. The output for 1923 was 350,000,000 pairs, an increase over the output for 1900 of 60 per cent, while the increase in population for the same period has been 40 per cent. The greater development has taken place largely in the Middle West and New York State, where there has been a marked example of sales initiative and economical production methods. The Middle West has been particularly prominent in moving towards simplification of lines and standardization of products with their resultant economies in sales and production.

Because of the complications of styles and intricacy of the manufacturing process, requiring from 75 to more than 200 operations on a pair of shoes, management policies become of vital importance in the conduct of a shoe factory. For example, a single company of moderate size will make some 750 styles of women's shoes in a single season. A typical factory of this kind will manufacture almost solely on an order, rather than a stock, basis and the size of production lots will range from a single pair to a case of 36 pairs, adding to the difficulty of controlling production.

The shoe industry is characterized by the number of small establishments. The Census of Manufactures for 1919 shows only 21 establishments employing over 1000 wage-earners, and 195 plants employing from one to five wage-earners. The mode in respect to size is found in the group employing from 101 to 250 wage-earners in which the number of establishments is 285. A shoe factory can be started on small capital, hence the number of new firms starting and ultimately failing is large. As would be expected this results in unintelligent price competition and stresses the need for intelligent management if a business is to survive and grow.

A basic element in the existence of the large number of small plants and the limited capital required to start a plant is the important part played by the United Shoe Machinery Company, which controls virtually all the machines except those employed for stitching the uppers. The policy of this company is to lease its machinery and therefore the initial investment required for machines is comparatively small.

Among the various problems to which the application of scientific treatment is particularly valuable are marketing, styles to manufacture, purchase of leather, production methods and control, wage setting, and cost accounting and control.

All the basic factors which apply to the selection of plant location in any industry apply with equal force to the shoe industry but the factor of type of labor available assumes an unusual importance. This is due to the element of superior skill involved in the combination of the style and quality factors. In the East, particularly Greater New York, where the shoemakers of Europe land, high-class labor for fine shoes is especially available, and adapts itself readily to American methods. A factory located in or near New York had the added advantages of being near a style center and a great consuming market for fine shoes. New England, which produces nearly 40 per cent of the shoes made in the United States, in a lesser degree shares in these advantages.

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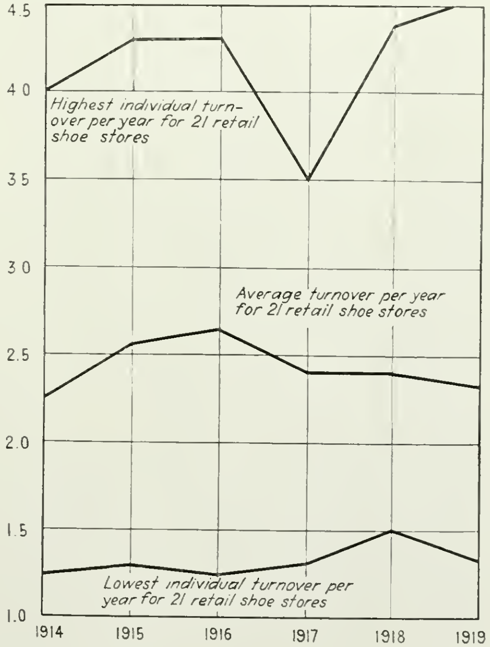


From "Waste in Industry"

Fig. 1 Stock Turnover in a Group of 21 Retail Stores
Shows average turnover, and turnover in the two stores of the group having the highest and lowest turnover respectively.

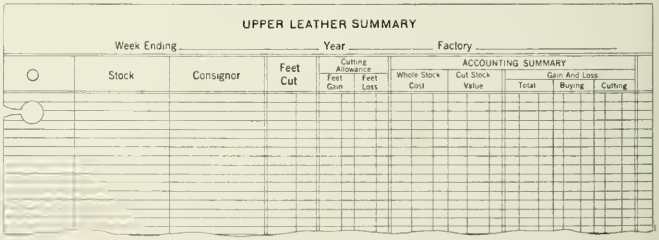
On the other hand, the cheaper styles of shoes can be made most economically in smaller cities or towns where the level of wages is lower. With this factor is combined a greater stability of labor, since the "floater," especially prevalent in the shoe industry on account of its seasonal production, usually confines his wanderings to the large shoe centers. As the cheaper styles of shoes are less subject to sudden style fluctuations and lend themselves to a program of standardization and manufacture for stock, the seasonal factor in production can be greatly lessened and this adds much to the stability of labor.

In the East and in the shoe centers, labor is largely organized. Unfortunately, no one large organization is dominant and the last few years have been marked by both labor strife between labor and employers and labor wars between unions. As the unions still practice some forms of restriction of output, and since barter for wage-settlements is not based upon scientific wage setting, the unions become an important factor for or against satisfactory conditions in plant location.

Management Problems in Marketing

The chaos that prevails in all marketing is found in the shoe industry. All the known channels of marketing are employed and each has its advocates, although selling direct to the consumer has made less progress than in many other commodities. Formerly the method of marketing was fairly uniform. The manufacturer made up each season a line of samples which his salesmen took to the jobbing trade. The jobber selected the shoes he thought he could sell and ordered samples for his own sales staff. These samples were later taken to the retail trade and the jobber estimated his purchase requirements from the early retail orders. He then traveled to the shoe centers, notably Boston, and placed a firm order for his season's business, later sending his fill-in orders by mail.

Gradually the manufacturers placed resident salesmen in the field and the seasonal peak of selling somewhat diminished. The greater part of the output bore the jobbers' private brands. As advertising to establish market control through brand preference became better known, many manufacturers tried to utilize this method to protect their own markets. Eventually these more progressive manufacturers found it necessary to establish exclusive agents and sell direct to the retailer, and as they grew in financial strength they turned to the establishment of their own retail outlets.


UPPER LEATHER SUMMARY

Week Ending __________ Year __________ Factory __________

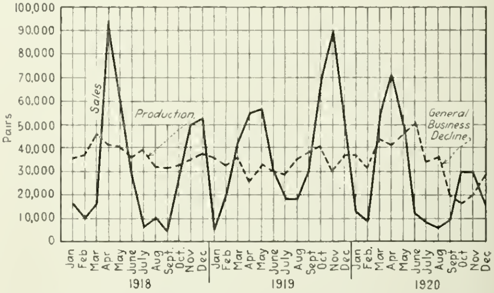
○	Stock	Consignor	Feet Cut	Cutting Allowance		ACCOUNTING SUMMARY				
				Feet Gain	Feet Loss	Whole Stock Cost	Cut Stock Value	Gain And Loss		
								Total	Buying	Cutting

Courtesy of J. F. McElwain Company

FIG. 3 UPPER LEATHER CUTTING SHEET, USED IN CONNECTION WITH UPPER LEATHER CUTTING RECORD AND UPPER LEATHER SUMMARY

Today the determination of a marketing policy is inextricably tied in with the elements of style of product and financial strength. If extreme style is the dominant appeal, direct selling is usually necessary. If the product is fairly well standardized as to quality and style, both the jobbing and retail channels may be employed. It is not uncommon to establish a policy of selling direct in centers of congested population and through jobbers in more sparsely settled regions. Both the jobber and retailer are keen to buy direct from the manufacturer of the highly-standardized, medium, or low-grade shoe, as the element of risk is lessened and the certainty of fast turnover of stock increased.

The manufacturer today can call to his aid well-understood principles of scientific methods to assist him in determining his marketing policies. Commercial research stands ready to disclose all the factors having to do with product, markets, and competition. Market research and analysis will make known the type of sales resistance to be overcome, the trade channels and merchandising methods to develop, style and price factors, and the position and influence of competition. Statistical market research will produce territorial sales valuations as a guide to sales organization, sales campaigns, sales budgets, and scientific forms of salesmen's compensation.



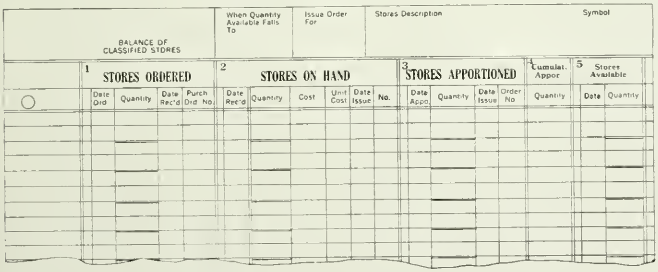
From "Waste in Industry"

FIG. 2 DIAGRAM ILLUSTRATING SEASONAL SALES AND EFFORTS TO OVERCOME BY OPERATING 51 WEEKS A YEAR

The manufacturer of the old school finds that he is now dealing with a new type of merchant and new merchandising methods. Both jobber and retailer have learned the lesson of the effect of fast turnover upon net profits. They are inclined to buy in smaller lots, more frequently and from nearby sources which can give them quick delivery service. They are keeping records of sales by style, size, and width as a basis for carefully planned and scheduled purchasing. They are steadily pushing the carrying of stocks and the creation of demand back upon the manufacturer, forcing him to use all that the science of management has developed in the way of planned production and stock control, scientific advertising and merchandising assistance. (See Fig. 1).

Styles are an ever-present problem in the shoe industry. Even the advanced manufacturer who had turned toward standardization and mass production as a basic policy finds it necessary to follow the larger, longer-swing style trends. The maker of women's fine shoes now finds himself trying to catch up with styles which are evanescent even before they can be clearly discerned. The big manufacturer with the routine essential to large-scale operation finds himself almost hopelessly distanced in the race for style leadership. The losses involved in frequent changes of lasts, patterns, dies, etc., make the adventure into the extreme style field hazardous and unprofitable. So it is largely the medium-size and small plants making women's footwear that choose to enter heavily into the style field with its gamble for large profits or large losses. Their effort is mostly to create styles, or to ride upon a wave of style some more fortunate maker has created. Their problem is one of personal skill and intuition, of close contact with style markets and the creators of styles in other fields of trade.

There are, however, more basic trends of style with which all manufacturers have to contend. Style usually combines elements both of design and color. Style research and analysis is best conducted in the form of co-operation within an industry, and with other industries affected by coincident style factors, such as leather, hosiery, and textiles. The individual establishment is not without resources within itself to make studies which will foretell style changes. Adequate records of sales and production, combined with effective reports by salesmen of their observations in the field, analyzed by a competent statistical worker and properly charted, will disclose trend lines before urgent measures are necessary to correct some unforeseen condition. Research workers of any kind are not frequently found in the shoe industry, but any plant advanced enough to have a cost system can quickly show an added profit by having one man on its pay-roll to do the simple type of statistical work that will give an executive the reports which call attention to trends, exceptions, and profit leaks.



BALANCE OF CLASSIFIED STORES

When Quantity Available Falls To

Issue Order For

Stores Description

Symbol

	1 STORES ORDERED				2 STORES ON HAND						3 STORES APPORTIONED				4 Cumulat. Appor	5 Stores Available	
○	Date Ord	Quantity	Date Rec'd	Purch Ord No.	Date Rec'd	Quantity	Cost	Unit Cost	Date Issue	No.	Date Appo.	Quantity	Date Issue	Order No	Quantity	Date	Quantity

Courtesy of Brown Shoe Company

FIG. 4 FORM FOR BALANCE OF CLASSIFIED STORES

Unstandardized style exerts a baneful influence in the shoe industry. A sudden style change may leave a manufacturer facing a large loss on inventories of leather, findings, lasts, patterns and dies. If he manufactures for stock, he may have to "job" finished goods at ruinous prices to dispose of them; if he makes to order, a flood of returned goods and cancellations cuts down or destroys his profits. The watching of style changes is primarily a sales problem—a sales research problem—and the results brought about demonstrate conclusively that a manufacturer can well apply scientific method to research, planning and control of his marketing operations and opportunities.

In the mind of one familiar with management methods in other lines of industry, the customary lack of any attempt to co-ordinate sales and production in the shoe industry underlies many of the evils of which the shoe manufacturer complains. There are, of course, a few notable exceptions, found only in those plants which are striving for all the economies which come from standardized mass production. The conception that a sales estimate to cover a season, or a fiscal or working period, must be the basis for financial, purchasing, and production programs has not taken root in the shoe industry. The complexities which stand in the way of formulating a sales estimate have loomed large, and the employment of a staff man or group to undertake the work is in direct conflict with the traditions of an industry which has always fought to keep the number of indirect workers to an apparently desirable minimum.

Tradition is one of the grandparents of inertia. It is largely inertia, and not lack of ability, which makes management in the shoe industry accept as inevitable the large losses from improperly planned purchasing; the sharp oscillations in the flow of production; the labor unrest which comes from seasons of unemployment and from waiting for work during hours of employment; idleness of plant and equipment; and the loss of good-will through failure to make scheduled deliveries to customers. To this list might be added a large number of less obvious—often not recognized—losses of which lack of material control, unbalanced production, and unbalanced piece rates are good examples. (See Fig. 2).

There is, to be sure, an underlying cause for the absence of co-ordinated programs. It is to be found in the almost utter absence of written plans, standards, and instructions, in the sense in which these terms are employed by the management engineer. The translation of the quantities and times of a sales estimate into a production program is virtually impossible in an industry where the times of various operations have never been scientifically studied and standards of performance have never been established. Tradition says that the labor leaders will not permit it. Tradition once said the same thing of the men's clothing industry.

There is an instinctive tendency to co-ordinate sales and production, as is shown by the increasing number of manufacturers who turn out a few staple lines for stock when customers' orders are slack. An attempt to establish a sales estimate or quota will inevitably lead to research and the gathering of fact data for the establishment of standards to aid in proper planning and control of sales efforts. Every step forward in this direction means that to an increasing degree future planning will aid current planning in production by forecasting definite requirements appreciably in advance of current needs.

Raw materials, particularly leather, are the major items in the cost of shoes. With so little forecasting of future requirements, leather purchase has necessarily been largely a gamble. This has been especially true of colored stock. Because of its elemental importance, its fluctuating prices, and the uncertainty of supply at the precise time when needed, there has naturally been a disposition to enter into commitments based largely upon guesses. Occasionally these guesses have resulted in a profit, due to advancing leather prices; on the other hand, there are some recent well-known cases where these commitments have resulted in the failure of the business. Better and more advanced production planning helps to take some of the gamble out of leather purchasing, and aids in retaining the legitimate profit which the manufacturer should make from his processing. Where the product is subject to frequent style changes, planning is necessarily limited to short periods.

Many manufacturers now, in order to protect themselves on their leather supply, place their orders for leather when the orders for shoes are received. This frequently means the carrying of an unused inventory for months, and cuts into the profits. The questions of weights, grain, and grade enter largely into the question of the availability of the inventory of leather, and considerable losses may ensue because the right kind of leather is not available when the order is issued to the cutting room.

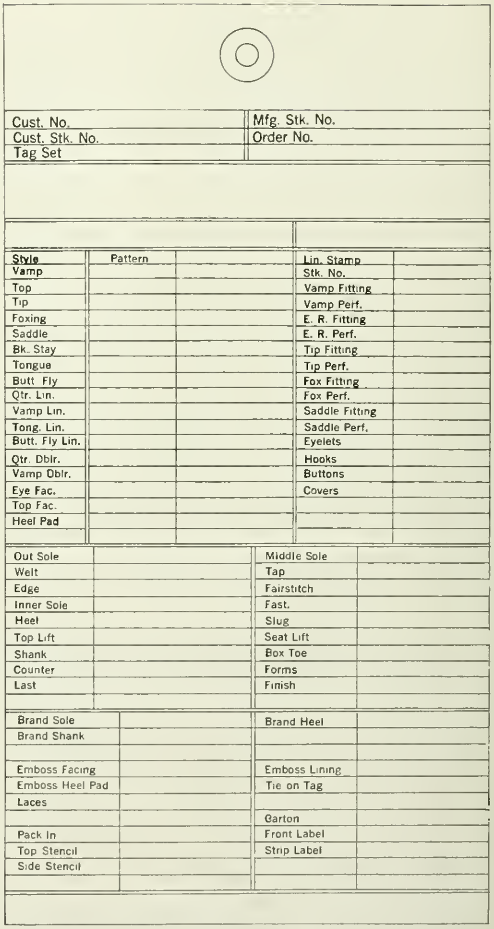
Only the larger manufacturers, making several kinds and grades of shoes, can afford to buy "run of stock". The smaller manufacturer, to escape this difficulty, tries to anticipate the grain and grade which he will need and orders a specific grade of stock. Experience and a certain shrewd intuition are a vital asset in such buying, but any type of planning which will help to remove the gamble from his leather purchases will be of inestimable benefit to the shoe manufacturer.

The purchase of findings and supplies is often entirely uncontrolled. It is a frequent occurrence for a part of a factory to lie idle because someone has not foreseen that certain items will be needed at a given time. This also usually leads to the piling up of work in process, a source of loss of profit due both to capital tied up in inventory and to unbalanced production. When missing supplies slow up or stop the turnover of lasts, another large profit leak is disclosed.

Gains Made by Proper Control of Materials

The need for the adequate control of stores is a marked feature in the shoe industry on account of the many items which enter into the shoe during the process of manufacture. Shoe production is peculiarly a chain process and the absence of a comparatively unimportant finding or supply means that the lot must wait until the missing part is obtained. If this occurs while the shoes are on the lasts, the problem becomes serious, as the lasts may be needed for other production.

While this situation is common, comparatively few factories have any real control of stores. Balance of stores records are rarely found, except in the larger plants. Even where in use, they are not always properly planned or maintained. The work of preparation in the form of issuing stores so that worker or foreman does not have to chase supplies or findings has made little progress in most plants.



Cust. No.	Mfg. Stk. No.
Cust. Stk. No.	Order No.
Tag Set	

Style	Pattern		Lin. Stamp	
Vamp			Stk. No.	
Top			Vamp Fitting	
Tip			Vamp Perf.	
Foxing			E. R. Fitting	
Saddle			E. R. Perf.	
Bk. Stay			Tip Fitting	
Tongue			Tip Perf.	
Butt Fly			Fox Fitting	
Qtr. Lin.			Fox Perf.	
Vamp Lin.			Saddle Fitting	
Tong. Lin.			Saddle Perf.	
Butt. Fly Lin.			Eyelets	
Qtr. Dblr.			Hooks	
Vamp Dblr.			Buttons	
Eye Fac.			Covers	
Top Fac.				
Heel Pad				

Out Sole		Middle Sole	
Welt		Tap	
Edge		Fairstitch	
Inner Sole		Fast.	
Heel		Slug	
Top Lift		Seat Lift	
Shank		Box Toe	
Counter		Forms	
Last		Finish	

Brand Sole		Brand Heel	
Brand Shank			
Emboss Facing		Emboss Lining	
Emboss Heel Pad		Tie on Tag	
Laces			
		Carton	
Pack In		Front Label	
Top Stencil		Strip Label	
Side Stencil			

Courtesy of J. F. McElwain Company

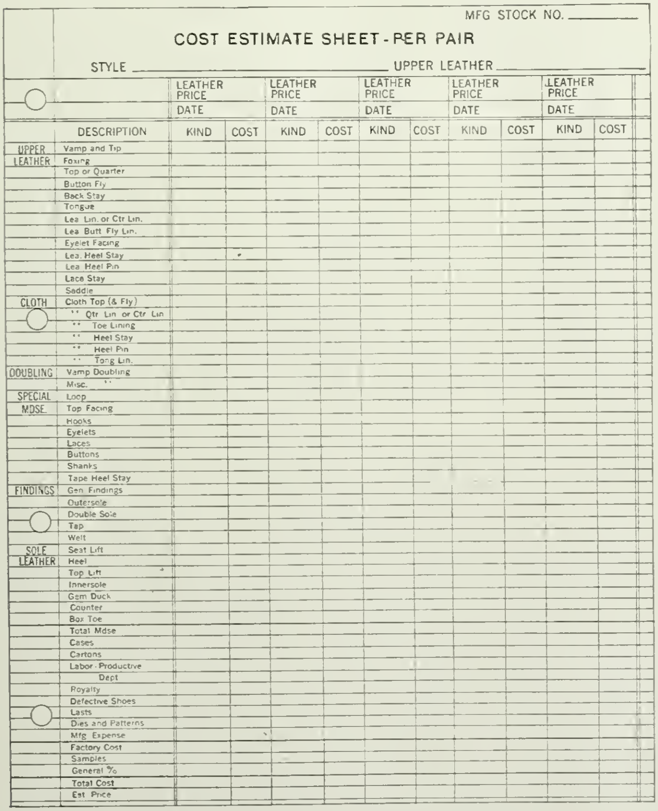
Fig. 5 Shoe Tag Used for Routing the Lots

The control of upper leather is of prime importance. Yet this item is one of those most often disregarded. No balance of stores is maintained, and frequently, even in large plants, stock can be found only by inspection of racks or bins. Apportioning of leather against future jobs is a form of control found in but few places. The saving by such control will in some cases amount to thousands of dollars a year. The use of a wrong grade of stock, because the right grade is missing, results either in an excessive cost or a cheapening of the grade of the shoe. Because of the lack of control, the inventories of upper leather are often far larger than necessary, resulting in an interest loss in carrying inventory which in many instances would far more than pay for the cost of control. (See Fig. 3).

Control of the other items of stores is relatively of equal importance. To hold thousands of pairs of shoes in a fitting room for days or weeks because eyelets of the right color are not available is not conducive to good workmanship or profits. Yet it is not an exceptional case, but is typical of daily occurrences in hundreds of plants.

Not alone is the maintenance of proper stores records lax, but the method of issuing stores is often entirely unguarded. Supplies are given to workmen without any knowledge of their requirements, and leaks from this source become in the aggregate a large item.

In laying out the best plan of control for the individual factory, on the other hand, over-complication must be avoided. For example, because of the passing of styles, the establishment of "minimums" as a notice to purchase—a method common in many industries—should not be adopted for all materials. The "minimum" method, left unguarded, becomes the source of many items of dead stock. It has been demonstrated in several plants that good balance records of the perpetual inventory form, showing goods on order, on hand, apportioned, and available, properly maintained and checked, provide a means for assuring a continuous flow of work and produce savings that far exceed the cost involved in the work of stores control. (See Fig. 4).



MFG STOCK NO. ________

COST ESTIMATE SHEET-PER PAIR

STYLE ________ UPPER LEATHER ________

		LEATHER PRICE		LEATHER PRICE		LEATHER PRICE		LEATHER PRICE		LEATHER PRICE	
		DATE		DATE		DATE		DATE		DATE	
	DESCRIPTION	KIND	COST	KIND	COST	KIND	COST	KIND	COST	KIND	COST
UPPER LEATHER	Vamp and Tip										
	Foxing										
	Top or Quarter										
	Button Fly										
	Back Stay										
	Tongue										
	Lea Lin. or Ctr Lin.										
	Lea Butt Fly Lin.										
	Eyelet Facing										
	Lea. Heel Stay										
	Lea Heel Pin										
	Lace Stay										
	Saddle										
CLOTH	Cloth Top (& Fly)										
	" Qtr Lin or Ctr Lin										
	" Toe Lining										
	" Heel Stay										
	" Heel Pin										
	" Tong Lin.										
DOUBLING	Vamp Doubling										
	Misc. "										
SPECIAL MDSE.	Loop										
	Top Facing										
	Hooks										
	Eyelets										
	Laces										
	Buttons										
	Shanks										
	Tape Heel Stay										
FINDINGS	Gen Findings										
	Outersole										
	Double Sole										
	Tap										
	Welt										
SOLE LEATHER	Seat Lift										
	Heel										
	Top Lift										
	Innersole										
	Gem Duck										
	Counter										
	Box Toe										
	Total Mdse										
	Cases										
	Cartons										
	Labor - Productive										
	Dept										
	Royalty										
	Defective Shoes										
	Lasts										
	Dies and Patterns										
	Mfg Expense										
	Factory Cost										
	Samples										
	General %										
	Total Cost										
	Est Price										

Courtesy of J. F. McElwain Company

Fig. 6 Cost Estimate Sheet

In a unit plant the plan of factory layout will control to some degree the extent to which centralization of stores will be advantageous. The type of planning will also be a factor. The less advanced the planning, the greater is the necessity for locating sub-stores in or near the departments which will use the supplies. In most plants, the physical stores are frequently decentralized, although in the better developed factories the stores records are maintained by the planning department.

As the planning of the sequence of production within a department is customarily controlled by the foreman, he usually makes out or approves all stores issues for the required materials or supplies. This is poor practice, and there is a marked tendency toward locating in the major departments the assembling points for bringing together the required parts or materials before a manufacturing lot is started in process. Thus the recognition of preparation as a separate function of production is making progress. There are certain parts, such as leather-covered wood heels, which would be subject to damage if permitted to go through preliminary processes with other parts, and these require special planning and scheduling to make sure that they are available when the lot reaches the heeling operation.

When a company operates several branch plants, the development of centralized stores is, of necessity, much more advanced. Contact with planning, and through planning with purchasing, is usually very close. Forms and records for control of stores and for the requisitioning of stores by the branch factories are in line with modern stores practices in other industries.

Multiplicity of Factors Considered in Planning

Few industries have to contend with so many or so complex details in planning as does the shoe industry. Leather, like many other natural products, is not uniform in weight, texture, or color, even in a single skin. To utilize it with the least waste necessitates having available a considerable variety of designs and sizes of patterns or dies. Frequently two or more manufacturing lots or cases must be given to the cutter at one time. Many varieties of style going through at one time means that each day's work must contain varied styles in the attempt to equalize the load factor upon machine equipment or available labor.

The balancing of operations is one of the most important factors in production management. To avoid machine and hand delays, a few plants work this balance out in careful detail. Usually it is left mostly to chance, and hence becomes a source of much friction with the operators.

The following type of planning is characteristic of most plants that have seriously attempted to solve this problem.

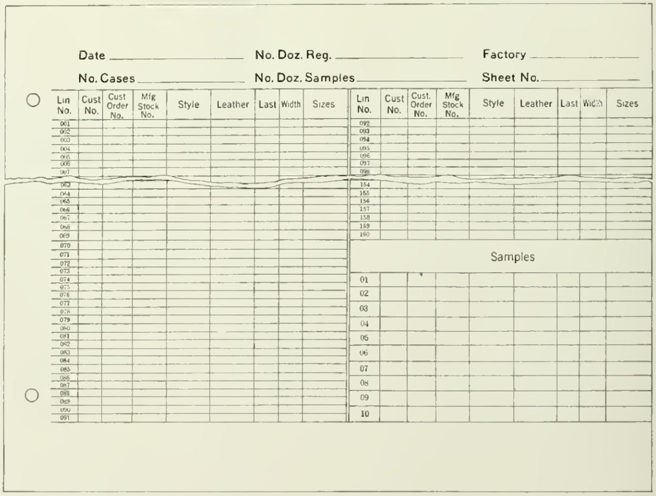
When an order is received, a master tag is made out to show the style and processing details required. The grouping of the details is by departments or combinations of departments. When manufacturing is largely to order, this tag shows a large number of details. Where standardized styles are made for stock, the amount of detailed information required is usually less and the tag is smaller and simpler. In the particular plant referred to, the manufacturing tags required for the work of the departments are copies of this master tag. In some plants, the instructions for specific departments are written on coupons which are detachable from the main tag which goes through with the uppers to the packing-room. (See Fig. 5).

An estimate of the cost of shoes of a given style is computed upon a special cost estimate form. This, in effect, is a bill of materials with added spaces for labor, royalty and burden charges. (See Fig. 6).

In the most up-to-date plant each block of orders received is analyzed on a special form to show the percentages of various styles and lasts. By comparing the results of this analysis with the inventories of dies and lasts any need for added equipment can be seen. These preliminary analysis sheets are further analyzed on another special form in order to maintain a reasonably constant proportion by styles over a given block. In this second analysis it is necessary to watch such items as patent leather, perforations, cork welts, etc., which affect the operations in various departments.

From the analysis, the planning department makes up a "day sheet" which lists the manufacturing lots to be made on a given day. The day sheets are numbered in sequence and each lot on a sheet carries a subordinate sequence number. This day sheet is designed to give a balanced day's production as the group of manufacturing lots or cases goes through the different departments. In effect, it is an over-all planning operation. Its usual weakness is that it is not built up of elements based upon general time study of operations, and the completion of a sheet in a specific department must be determined by the time required to complete operations on the lot requiring the longest operating time. The net result in most shops is that considerable production chasing is required to push along lots that have lagged behind the sheet. In practice each lot bears a large tag, sometimes colored, carrying in large print the sheet number. Each operator, in turn, is supposed to select from work ahead a lot which carries a tag designating the day sheet longest in the department at the time. (See Fig. 7).

Theoretically, and to some degree actually, the day sheet method serves to balance production throughout the plant. It also materially helps in planning the issuance of materials and stores and in the scheduling of preparation and production. In fact, however, the actual time required for processing the various lots on a day sheet varies greatly, and unquestionably increases to a great extent the inventory of the work in process. In even the best managed plants a considerable amount of idleness on the part of operators and equipment can be observed. In plants less skilfully managed the loss of time in operators waiting for work is a source of open complaint and is one of the prime reasons why operators fight hard for the highest obtainable piece rates. The operators have learned from long experience that this is about the only way by which they can protect themselves against the management's weakness in planning, and thus obtain satisfactory weekly or annual earnings for themselves. For this is their real goal, and not to obtain a high piece rate and then suffer a loss by partial idleness.



Date ______ No. Doz. Reg. ______ Factory ______
No. Cases ______ No. Doz. Samples ______ Sheet No. ______

○

Lin No.	Cust No.	Cust Order No.	Mfg Stock No.	Style	Leather	Last	Width	Sizes
001								
002								
003								
004								
005								
006								
007								
063								
064								
065								
066								
067								
068								
069								
070								
071								
072								
073								
074								
075								
076								
077								
078								
079								
080								
081								
082								
083								
084								
085								
086								
087								
088								
089								
090								
091								

○

Lin No.	Cust No.	Cust. Order No.	Mfg Stock No.	Style	Leather	Last	Width	Sizes
092								
093								
094								
095								
096								
097								
098								
154								
155								
156								
157								
158								
159								
160								
Samples								
01								
02								
03								
04								
05								
06								
07								
08								
09								
10								

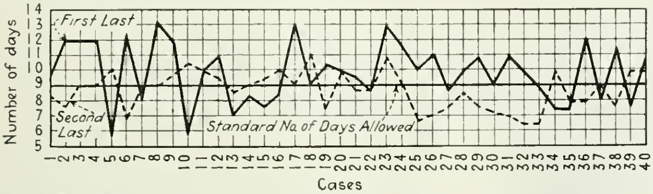
Courtesy of J. F. McElwain Company

FIG. 7 DATA SHEET FOR SCHEDULING A DAY'S WORK

Problem of the Turnover of Lasts

One of the major problems in shoe manufacturing is the proper efficiency in the use of lasts, which are a large item in the equipment inventory and are subject usually to a very rapid depreciation owing to the style changes. There must be enough lasts of each style, size, and width to keep production flowing. The time of the turnover of lasts—from bin back to bin—has been studied by the better managers and a theoretical turnover time set for each style of shoes. A chart of the actual turnover of lasts in one of the better factories shows that a planned 9-day turnover may actually take from 6 to 13 days. This condition demonstrates that production control offers an opportunity for real savings, and clearly indicates that better planning must precede the effort for better control.

One way by which an attempt is made to get some control of this last problem is to set up a last analysis sheet. This is a form on which each style, size and width of last has its individual column at the top of which is placed the number of lasts owned, from which is subtracted the number called for by the day sheet being analyzed. This number of lasts is added to the column at the end of the scheduled turnover period as being again available. There is ordinarily no physical check to determine that the lasts are actually back in the bins. The errors in the working of this scheme become evident when the assembling department finds that lasts called for on the day sheet are not available owing to slowing of the normal turnover period, and that emergency measures are called for to correct the situation. (See Fig. 8).



From "Waste in Industry"

FIG. 8 VARIATION IN THE TURNING OF LASTS IN A TURN SHOE FACTORY (WOOD HEELS) COVERING A FOUR-WEEK PERIOD

Two different styles of lasts are shown. Standard number of days allowance is nine.

The importance of the promised delivery period is usually such that it pays a manufacturer to carry a surplus inventory of lasts rather than to lose scheduled production. This becomes one of the many wastes in the industry which will be lessened with more specific and scientific planning.

Where labor unions thrive and multiply, and strikes and lockouts are frequent, it can be reasonably certain that the science of management is not likewise growing. Such has been the condition in several shoe cities for many years. On the other hand, there are centers where one union, which was formerly the only union of any importance, has so maintained its contracts with employers that strikes are virtually unknown and management has made much progress.

In general, the shoe industry is characterized by the absence of personnel departments and constructive personnel policies. The conception that labor management is a vital part of the profession of management and that it must be recognized as a profit-making factor in industry meets but little response in the form of management activity.

The unions do impose harassing restrictions, frequently unwarranted, in many instances. These restrictions mostly take the form of limiting output, forbidding changing operators to other work, maintaining a full corps regardless of demand, and to some degree hampering the education of apprentices. The troublesome matter is the setting of day and piece prices. The centralizing of decisions has resulted in the making of rates for classes of operations, regardless of quantity or quality of performance, or differences in operating methods, or in machine equipment. Rates are set covering cities or districts without reference to individual differences between working conditions in plants. Employee representation is through the union agent and rates are a matter of barter, based almost wholly upon judgments and opinions in place of analysis and study. The manufacturers, however, usually are equally responsible for the situation, many of them failing to recognize the fundamental principles of standardization of rates.

Piece rates prevail in most departments in the shoe factories. There is little science in the way they are determined and as a result troubles over rates are frequent and general. Because they rest so seldom upon a scientific basis of job analysis and time study, they are usually out of balance, and the effect of war-time rates in this and other industries has made the unsettled condition more pronounced. A few isolated cases where scientific rate setting has been attempted show that there are no insurmountable obstacles in the way of righting the present bad condition. In one or two instances labor unions are taking the initiative.

A recent study of the abnormalities of rates in different localities, and for both similar and different types of operations, shows conclusively that in this field lies one of the greatest opportunities of the shoe industry. There is so little of standardization of policies, methods, and working conditions, even in the plants of a single city, and so little of standardization of products, that the attempt to make level district rates is farcical. In handling groups of factories, allowances must be made for individual conditions.

The past two years have been marked by the rapidity of style changes, particularly in women's shoes. In one city, 600 changes of piece prices was a previous high annual mark; last year in that city more than 6,000 new piece prices were established. If the tasks formerly performed had been analyzed into their elements and these elements time-studied, it would have been comparatively simple to build up new piece prices on a scientific and fair basis, for the new tasks are largely only new combinations of the elements of the former tasks. When it is considered that the new piece prices were mostly set in advance of actual production, so that cost estimates are the base for selling prices of new samples, one can readily appreciate that earnings are badly out of balance.

There is little likelihood that there will be lessening of industrial unrest until rates are set that will give comparable earnings for similar skill and expenditure of energy. The experience of other industries clearly points out that an attempt to balance wage rates will react to force standardization of working conditions, which in turn emphasizes the need for better planning and control. To carry the chain of thought further, planning and control must inevitably lead to more general research in all the fields of management endeavor and mark the opening of a new day in the industry.

Savings Brought About by the Use of Electric Trucks

THE Matson Navigation Company, one of the largest users of the so-called "jitney" or electric industrial truck on the Pacific coast, was among the pioneers in the adoption of this highly efficient means of handling package goods. Their experimentation with this equipment started early in 1916, at which time much opposition to the idea developed, as the workmen feared that a number of men would be laid off. This condition of antipathy toward the trucks existed for nearly two years, and trucks were used only spasmodically.

Due to the increase of business, it gradually came about that the number of men employed was increased, rather than lessened. As a specific illustration of the way in which the use of trucks affected the number of men employed, an investigation made by Captain Saunders of the Matson Navigation Company, to check the results of loading freight cars with both hand-trucks and electric trucks, showed the following results:

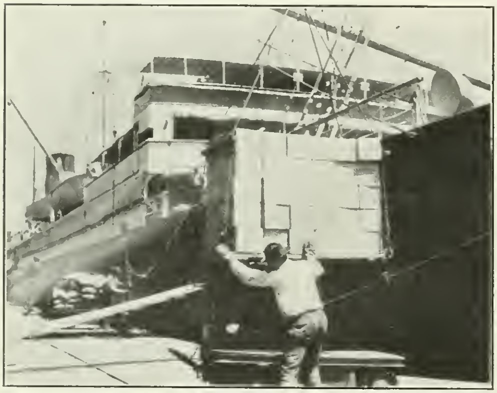


Fig. 1 Use of Electric Trucks Quadruples Hoist Loads

Two carloads of cased goods, consisting of pineapple, were loaded at the same time. The first carload was loaded by hand-truck method, in which 11 men were employed to truck 1050 cases 500 ft. This required 1 hr. 55 min. at a total cost of $13.20. In loading another car, one electric truck was used. Nine men were employed, the time consumed was 1 hr. and 10 min., and 1140 cases were moved 400 ft. The total cost, including operating of electric trucks, was $7.05.

Due to the constant effort on the part of the steamship operators to lessen time required to load and unload ships, it was found that the electric truck afforded a marked advantage, in that, as shown in the above paragraph, only one truck was required to keep 8 men busy handling material onto and off of the platforms. This method also did away with a considerable amount of trouble as compared with the use of hand-trucks. Where the latter were employed, 4 or 5 trucks were necessary and frequently congestion resulted when the trucks met in close quarters, as in freight car loading. With the gradual increase in the use of electric trucks by the company and because of the larger loads and the greater speed possible with these trucks, it was found that a much greater tonnage could be moved with the same number of men. The loading and discharge of ships, notwithstanding the large increase in business, was speeded up, and many hours were saved.

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After three or four years of limited trial as the above facts gradually became evident, a more extensive use of trucks was decided on by officials of the company and more trucks were purchased. A whole fleet has now been put into service and a tremendous amount of freight is moved in a comparatively few hours, by the substitution of this equipment for hand labor.

Another feature of the adoption of electric trucks is the improvement which they brought about in the methods of loading and unloading vessels. For instance, it was found possible to increase the size of sling load lifted at one time. Fig. 1 shows a load of 60 cases of pineapple hoisted from the hold of a boat and being set on an electric truck. Before these trucks were put into use the standard sling load was 15 to 18 cases. This increase in size of loads has materially increased the handling capacity of the ship's cargo gear.

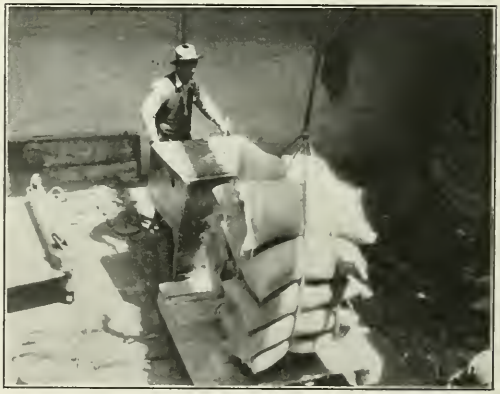


Fig. 2 Electric Truck in Hold of Ship Serving Cargo Hoist

Fig. 2 illustrates still another advantage obtained. It shows the use of a truck in the hold of a ship. After a portion of the freight has been removed, so as to reach a section of the bottom of the vessel, a truck with platform is lowered into the hold. Here it is used to bring loads up to the hook. When hand methods were employed these loads were only about one-quarter of the present size because the hand trucks on the dock could carry no more. Now that electric trucks are employed and sling loads have been increased it is necessary to bring freight up to the hook faster. The limited capacity and large number of men required by hand labor left this method out of the question. The use of a truck in the ship's hold solved the problem and insured a speedy unloading of the ship.

Specifications for Pipe Fittings

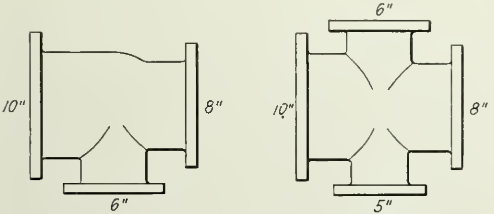
By HUBERT E. COLLINS

Mechanical Engineer

MUCH pipe can be ordered under the qualifying figures for the quantity written on the Bill of Material, but it is somewhat different when specifying pipe fittings.[1] Ordinarily a large bill of fittings will comprise many sizes each of which must be separately specified. Where the sizes vary on one fitting, the dimension of each opening must be specified.

Fig. 1 is a skeleton sketch of a tee and a cross. When the opening sizes vary on a tee the largest size "on the run" must be set down first, then the smallest on the run, and the size of the outlet last. With crosses, the largest size on the run must be set down first, then smallest on the run, largest side outlet, and smallest side outlet last.

With fittings the same size at all openings, specify the pipe size only. With fittings of varying size openings, specify each in the order indicated.



T-10"x 8"x 6" Cross-10"x 8"x 6"x 5"

FIG. 1 SKELETON SKETCH OF TEE AND CROSS

American Society of Mechanical Engineers standards of dimensions for both screwed and flanged fittings are contained in tables of dimensions in the catalog of every manufacturer of fittings or valves, supply houses, or can be secured from the American Society of Mechanical Engineers headquarters. The tables give dimensions for standard weight fittings (125 lb. pressure), and extra heavy fittings (from 125 to 250 lb. pressure).

Some notes on these tables follow:

Notes on the American Standard for Flanged Fittings

1. Standard and extra heavy reducing elbows carry the same dimensions "center-to-face" as regular elbows of largest straight size.
2. Standard and extra heavy tees, crosses, and laterals, reducing on the run only, carry same dimensions "face-to-face" as largest straight size.
3. If flanged fittings are made for lower working pressure than 125 lb. they conform in all dimensions, except thickness of shell, to the standard and have the guaranteed working pressure cast on each fitting. Flanges for these fittings must be standard dimensions.

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4. Where long radius fittings are specified, it has reference only to elbows which are made in two center-to-face dimensions, to be known only as elbows and long radius elbows, the latter being used only when so specified.
5. All standard weight fittings must be guaranteed for 125 lb. working pressure, and extra heavy fittings for 250 lb. working pressure, and each fitting must have some mark cast on it indicating the maker and the guaranteed working pressure.
6. All extra heavy fittings and flanges are to have a raised surface 1/16 in. high, inside the bolt holes for gaskets. Standard weight fittings and flanges are to be plain-faced. Bolt holes must be ⅛ in. larger than bolts, and straddle the center line.
7. The face-to-face dimensions of reducers, either straight or eccentric, for all pressures, shall be the same face-to-face dimensions as given in the tables.
8. Square head bolts with hexagonal nuts are recommended. For bolts ⅝ in. in diameter and larger, studs with a nut on each end are satisfactory. Hexagonal nuts for pipe sizes 1 to 46 in., 125 lb. standard, and 1 to 16 in., 250 lb. standard, can be tightened with open wrenches. Hexagonal nuts for pipe sizes 48 to 100 in., 125 lb., and 18 to 48 in., 250 lb. standard, can be tightened with box wrenches.
9. Twin elbows, whether straight or reducing, carry the same dimensions center-to-face and face-to-face as regular straight-size ells and tees. Side outlet elbows and side outlet tees, whether straight or reducing sizes, carry the same dimensions center-to-face and face-to-face as regular tees having the same reductions.
10. Bull-head tees or tees increasing an outlet will have the same center-to-face and face-to-face dimensions as a straight fitting of the size of the outlet.
11. Tees and crosses 9 in. and under, reducing on the outlet, have the same dimensions as straight sizes of the larger port. Sizes 10 in. and over, reducing on the outlet, are made in two lengths, depending on the size of the outlet as given in the tables of dimensions. Laterals 3½ in. and under, re-

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[1] See MANAGEMENT AND ADMINISTRATION for July 1924, p. 577, for article on "Pipe Specifications and Bills of Material," by Hubert E. Collins.

ducing on the branch, use the same dimensions as straight sizes of the larger port. Sizes 4 in. and over reducing on the branch, are made in two lengths, depending on the size of the branch as given in the table of dimensions.

12. Dimensions of reducing flanged fittings always are regulated by the reduction of the outlet or branch. Where they reduce on the run only, the long body pattern is used. Laterals are special and made to suit conditions. Double sweep tees are not made, reducing on the run.
13. With fittings reducing on the run only, the long body pattern will always be used, except on double sweep tees, on which the dimensions will always be given on request, and always be longer than the regular fitting.

Kind and Quality

When considering the kind of fittings wanted first specify—"screwed" or "flanged". The following list contains standard fittings in each class.

LIST OF FITTINGS

SCREWED

Straight elbow (L).
Reducing elbow (reducing L).
45 deg. elbow (45 deg. L).
Straight tee (T).
Reducing on outlet tee (reducing outlet T).
Reducing on run tee (reducing run T).
Straight cross (cross).
Reducing cross.
Lateral branch (Y).
Reducer.
Eccentric reducer.
Bushing (bush).
Eccentric bushing (eccentric bush).
Plain cap.
Ribbed cap.
Octagon cap.
Lock nut.
Plug.
Counter sunk plug.
Close return bend (bend).
Open return bend (open bend).
Back outlet return bend (back outlet bend).
Side outlet return bend (side outlet bend).
Union (U).
Ground joint union (ground U).
Union elbow (U L).
Union tee (U T).

FLANGED

Straight elbow (L).
Reducing elbow (reducing L).
Twin elbow (twin L).
Side outlet elbow (side outlet L).
Long radius elbow (long rad. L).
45 deg. elbow (45 deg. L).
Extension elbow with base (extension L with base).
Elbow with tapped drain bosses (L with tapped bosses).
Straight tee (T).
Single sweep tee (single sweep T).
Double sweep tee (double sweep T).
Side outlet tee (side outlet T).
Tee with tapped drain bosses (T with tapped bosses).
Lateral branch (Y).
Reducing lateral (reducing Y).
Short body reducing lateral (short body reducing Y).
Cross.
Reducer.
Reducing flange.
Eccentric reducer.

TABLE 1. CLASS OF SERVICE FOR GASKETS

CONVEYED	GASKETS	
	MATERIAL	THICKNESS In.
STEAM		
Superheated	Corrugated Steel or Monel	
Saturated	Comp. Asbestos	$1/16$
Exhaust	Comp. Asbestos or Red Rubber	$1/16$ and $1/8$
WATER		
Suction and Discharge	Red Rubber or Oiled Paper	
Boiler Feed	Corrugated Monel or Comp. Asbestos	$1/16$
Boiler Blow-off	Comp. Asbestos or Red Rubber	$1/16$
Cold	Cloth inserted or Red Rubber	$1/16$ and $1/8$
Service	Red Rubber	$1/16$
City	Red Rubber	$1/16$
Fire	Red Rubber	$1/16$
Ash Wetting		
Gland		
Coolers		
Air and Gas	Red Rubber	$1/16$
Oil	Composition Asbestos	$1/16$
Boilers and Feed-Water Heaters		
Breeching		
Doors and Clean Out		
Acids and Ammonia, Mother Liquor	Pure Sheet Lead	$1/16$ and $1/8$
Benzol	Composition Asbestos	

In addition to these fittings there are other items to be specified, such as: pipe brackets; pipe rollers; pipe supports; pipe chairs; pipe anchors; pipe I-beam clamps.

The first two are made of cast iron, while the balance are generally of wrought iron. There are numerous varieties of each, and the type desired should be indicated in a sketch if it cannot be described in any other way.

Pipe flanges must be specified as to type and make-up. There are 4 general types which are now in general use—screwed, vanstone, shrunk, welded.

The screwed joint is the cheapest to make up, the price of the other joints increases in the order given here with the welded joint the most costly of all—for example, the Crane Company estimate on a given size pipe that the vanstone joint costs 21 per cent more than the screwed; the shrunk joint 26 per cent more; and the welded joint 79 per cent more.

The method of finishing the flange faces to make a tight joint must be considered next. The various methods are:

1. *Plain straight face.* This type is faced entirely across and uses either a full face or ring gasket. It is used for pressures up to 125 lb. on steam or water lines.

Full face gaskets are preferred by some because of less trouble to insert between two flanges in place; but a ring gasket, properly proportioned and correctly installed will make as tight a joint as the other, with less expense and pulling up on bolts.

2. *Raised face, smooth finish for gasket.* This type is a raised face, finished inside the bolt circle, with the finished face 1/32 to 1/16 in. above the surface outside the circle. It is very satisfactory on high-pressure steam lines. Ring gaskets are used entirely.

TABLE 2. GASKETS FOR STANDARD AND LOW PRESSURE FLANGED VALVES AND FITTINGS

RUBBER RING GASKETS		CORRUGATED COPPER FULL FACE GASKETS	
Ring Gaskets		Full Face Gaskets	
Size of Valve or Fitting In.	Inside and Outside Diameters In.	Size of Valve or Fitting In.	Inside and Outside Diameters In.
¾	¾ x 2⅛	¾	¾ x 3½
1	1 x 2 9/16	1	1 x 4
1¼	1¼ x 2 15/16	1¼	1¼ x 4½
1½	1½ x 3⅜	1½	1½ x 5
2	2 x 4⅛	2	2 x 6
2½	2½ x 4⅞	2½	2½ x 7
3	3 x 5⅜	3	3 x 7½
3½	3½ x 6⅜	3½	3½ x 8½
4	4 x 6⅞	4	4 x 9
4½	4½ x 7	4½	4½ x 9¼
5	5 x 7¾	5	5 x 10
6	6 x 8¾	6	6 x 11
7	7 x 10	7	7 x 12½
8	8 x 11	8	8 x 13½
9	9 x 12½	9	9 x 15
10	10 x 13⅜	10	10 x 16
12	12 x 16⅛	12	12 x 19
14	14 x 17¾	14	14 x 21
15	15 x 19	15	15 x 22⅛
16	16 x 20¼	16	16 x 23½
18	18 x 21⅝	18	18 x 25
20	20 x 23⅞	20	20 x 27½
22	22 x 26	22	22 x 29½
24	24 x 28¼	24	24 x 32
26	26 x 30½	26	25 x 34¼
28	28 x 32¾	28	28 x 36½
30	30 x 34⅝	30	30 x 38¾
32	32 x 37	32	32 x 41¾
34	34 x 39	34	34 x 43¾
36	36 x 41¼	36	36 x 46
38	38 x 43⅝	38	38 x 48¾
40	40 x 45⅝	40	40 x 50¾
42	42 x 47⅞	42	42 x 53
44	44 x 50⅛	44	44 x 55¼
46	46 x 52⅛	46	46 x 57¼
48	48 x 54⅜	48	48 x 59½
50	50 x 56½	50	50 x 61¾

3. *Raised face, finished for ground joint.* This type is identical with No. 2, except that the finished faces are ground, making a perfectly tight joint without a gasket.

4. *Tongue and groove.* This type is popular on high-pressure water, gas, or air lines. The gasket area is reduced to fit the groove, thereby increasing the pressure that can be placed on it from the flange bolts. Placing the gasket in the groove where it is held by the tongue prevents its blowing out. This type of joint is more expensive to make and to work on than the raised face. For hydraulic or ammonia lines there is no better joint.

5. *Male and female* type is used on high-pressure steam lines and in hydraulic service. A cup-shaped gasket is used and will not blow out, but the joint is as expensive and troublesome as the tongue and groove joint and does not carry the advantage of a thinner, cheaper gasket.

6. In the *plain face, corrugated* joint, a round nose tool has been used to make corrugations in the surface of the flange. Its use is desirable where especially thick gaskets are necessary, and prevents their blowing out.

7. A diamond point tool is used on the faces in the *plain face, scored* type, to score concentric rings in the surfaces. This is where lead gaskets are to be used on oil or acid lines. The gasket squeezes into the scores and assists in making a tight joint without undue pressure on the bolts.

8. *Ball shape for ground joint* is for use on misaligned piping or where this condition is liable from settlement of buildings or other causes. It has inserted parts and non-corrosive rings.

For all sizes of fittings and flanges for which the table of dimensions referred to can be used, there is choice of the following materials: cast iron, cast steel, brass.

The Crane Company also have a quality named Ferro-Steel, which is a mixture of iron and steel. The advantage of this material is in its strength. It gives an extra heavy strength in a standard thickness. The dimensions otherwise are for extra heavy, including the drilling of the bolt circle.

Steel flanges and fittings are recommended for use on superheated steam lines. Some manufacturers make brass fittings and flanges light weight, and in specifying them, always call for iron fitting sizes and thickness.

When ordering gaskets, the quantity of a given

TABLE 3. GASKETS FOR MEDIUM AND EXTRA HEAVY FLANGED VALVES AND FITTINGS

RING GASKETS		FULL FACE GASKETS	
Size of Valve or Fitting In.	Inside and Outside Diameters In.	Size of Valve or Fitting In.	Inside and Outside Diameters In.
1	1 x 2¾	1	1 x 4½
1¼	1¼ x 3¼	1¼	1¼ x 5
1½	1½ x 3⅞	1½	1½ x 6
2	2 x 4⅜	2	2 x 6½
2½	2½ x 5⅛	2½	2½ x 7½
3	3 x 5⅞	3	3 x 8¼
3½	3½ x 6½	3½	3½ x 9
4	4 x 7⅛	4	4 x 10
4½	4½ x 7¾	4½	4½ x 10½
5	5 x 8½	5	5 x 11
6	6 x 9⅞	6	6 x 12½
7	7 x 11	7	7 x 14
8	8 x 12⅛	8	8 x 15
9	9 x 13	9	9 x 16¼
10	10 x 14¼	10	10 x 17½
12	12 x 16⅝	12	12 x 20½
14	14 x 19⅛	14	14 x 23
15	15 x 20¼	15	15 x 24½
16	16 x 21¼	16	16 x 25½
18	18 x 23½	18	18 x 28
20	20 x 25⅝	20	20 x 30½
22	22 x 27¾	22	22 x 33
24	24 x 30⅜	24	24 x 36

size means a certain number of gaskets for flanges on specified pipe size. Gaskets for use on pipe connections are in some form of ring. There are also *plain* and *corrugated gaskets,* and these two may be either full face or ring form. The full face gasket is cut to cover the full face of the flange from the inside to the outside diameters, while the ring type may be to cover the flange face from the inside diameter to the inside edges of the bolt holes, or to fit in a groove.

The material (quality) varies with the class of service to which the gasket is to be applied. An idea of the range of this point can be gained from Table 1.

Gaskets for manhole and handhole plates for boilers often need specifying, along with pipe, pipe-fittings, and accessories, and there are two points in relation to them which it is well to know. Manhole and handhole openings are elliptical in shape and the size must include the longest distance of the opening, as well as the shortest. The thickness is taken care of by the experienced manufacturer, who considers the pressures and fluid to be handled.

The material is generally rubber, asbestos, asbestos-metallic, or lead. The writer has used all these materials for steam and water. Lead gaskets are hard to use on cold water lines and their use is not advisable.

Valves

The quantity is given of each separate size or type, and the sizes given are sizes of pipe they are to be connected to.

All valves come under one of several kinds of which the following is a list of the best known:

Globe, straight.
Globe, angle.
Globe, male inlet, union nut on outlet.
Globe, male inlet, female outlet.
Globe, three-way, female inlet and outlet.
Globe, angle, needle point.
Globe, angle, female inlet, female union outlet.
Globe, angle, male inlet, female union outlet.
Globe, radiator, all variations of male and female connections.
Check valve, horizontal.
Check valve, up-flow. (Check valves can be either swing, ball, or disc).
Gate, straight.
Gate, angle.
Gate, quick opening lever.
Gate, radiator, male and female connections.
Safety valve, weight. (Also called relief valves).
Safety valve, spring. (Also called relief valves).
Automatic stop-check.
Automatic non-return and emergency cut-out.
Back pressure and exhaust relief.
Pressure regulator.

TABLE 4. GASKETS FOR MEDIUM AND EXTRA HEAVY FLANGED VALVES AND FITTINGS

Gaskets for Male and Female Joints		Gaskets for Tongued and Grooved Joints	
Size of Valve or Fitting In.	Inside and Outside Diameters In.	Size of Valve or Fitting In.	Inside and Outside Diameters In.
1	1 x 2 5/16	1	1¾ x 2½
1¼	1¼ x 2¾	1¼	2⅛ x 3
1½	1½ x 3⅛	1½	2¾ x 3⅝
2	2 x 3⅝	2	3⅛ x 4⅛
2½	2½ x 4⅛	2½	3⅝ x 4⅝
3	3 x 5	3	4¼ x 5¼
3½	3½ x 5½	3½	4¾ x 5¾
4	4 x 6	4	5¼ x 6¼
4½	4½ x 6½	4½	5¾ x 6¾
5	5 x 7¼	5	6¼ x 7¼
6	6 x 8⅜	6	7½ x 8½
7	7 x 9⅜	7	8⅝ x 9⅝
8	8 x 10⅝	8	9⅝ x 10⅞
9	9 x 11⅝	9	10⅝ x 11⅞
10	10 x 12¾	10	11⅝ x 13⅛
12	12 x 15¼	12	13⅝ x 15⅛
14	14 x 16½	14	15⅞ x 17⅜
15	15 x 17½	15	17⅛ x 18⅝
16	16 x 18½	16	18⅜ x 20⅛
18	18 x 21	18	20⅜ x 23⅜
20	20 x 23	20	22 5/16 x 24 5/16
22	22 x 25½	22	24½ x 26½
24	24 x 27½	24	26½ x 28½

TABLE 5. RING AND FULL FACE GASKETS FOR WATER SERVICE

Low 50 Lb. W P.				Standard 125 Lb. W. P.				250 and 350 Lb. W. P.				Pipe Size In.
Pipe Size In.	Flange Diam. In.	Gaskets		Pipe Size	Flange Diam. In.	Gaskets		Pipe Size In.	Flange Diam. In.	Ring Gaskets.		
		O. D. In.	I. D. In.			O. D. In.	I. D. In.			O. D. In.	I. D. In.	
20	27½	24⅛	19⅝	1	4	2 9/16	1⅛	1	4½	2¾	1⅛	1
22	29½	26⅜	21⅝	1¼	4½	2 15/16	1⅜	1¼	5	3¼	1⅜	1¼
24	32	28⅝	23⅝	1½	5	3⅝	1⅝	1½	6	3⅞	1⅝	1½
26	34¼	30¾	25⅝	2	6	4⅛	2⅛	2	6½	4⅜	2⅛	2
28	36½	33	27⅝	2½	7	4⅞	2⅝	2½	7½	5⅛	2⅝	2½
30	38¾	35	29⅝	3	7½	5⅜	3⅛	3	8¼	5⅞	3⅛	3
32	41¾	37½	31⅝	3½	8½	6⅜	3⅝	3½	9	6½	3⅝	3½
34	43¾	39½	33⅝	4	9	6⅞	4⅛	4	10	7⅛	4⅛	4
36	46	41¾	35⅝	4½	9¼	7	4⅝	4½	10½	7¾	4⅝	4½
38	48¾	44⅛	37⅝	5	10	7¾	5⅛	5	11	8½	5⅛	5
40	50¾	46⅛	39⅝	6	11	8¾	6⅛	6	12½	9⅞	6⅛	6
42	53	48⅜	41⅝	7	12½	10	7⅛	7	14	11	7⅛	7
44	55¼	50⅝	43⅝	8	13½	11	8⅛	8	15	12⅛	8⅛	8
46	57¼	52⅝	45⅝	9	15	12½	9⅛	9	16¼	13	9⅛	9
48	59½	54⅞	47⅝	10	16	13¾	10⅛	10	17½	14¼	10⅛	10
50	61¾	57⅛	49⅝	12	19	16⅛	12⅛	12	20½	16⅝	12⅛	12
52	64	59⅜	51⅝	14	21	17¾	13⅝	14	23	19⅛	13⅝	14
54	66¼	61⅝	53⅝	15	22¼	19	14⅝	15	24½	20¼	14⅝	15
56	68¾	63¾	55⅝	16	23½	20¼	15⅝	16	25½	21¼	15⅝	16
58	71	66	57⅝	18	25	21⅝	17⅝	18	28	23½	17⅝	18
60	73	68	59⅝	20	27½	23⅞	19⅝	20	30½	25⅝	19⅝	20
62	75¾	70½	61⅝	22	29½	26	21⅝	22	33	27¾	21⅝	22
64	78	72¾	63⅝	24	32	28¼	23⅝	24	36	30⅜	23⅝	24
66	80	74¾	65⅝	26	34¼	30½	25⅝	....	....	....	....	....
68	82¼	77	67⅝	28	36½	32¾	27⅝	....	....	....	....	....
70	84½	79¼	69⅝	30	38¾	34⅝	29⅝	....	....	....	....	....
72	86½	81¼	71⅝	32	41¾	37	31⅝	....	....	....	....	....
74	88½	83¼	73⅝	34	43¾	39	33⅝	....	....	....	....	....
76	90¾	85¼	75⅝	36	46	41¼	35⅝	....	....	....	....	....
78	93	87⅜	77⅝	38	48¾	43⅝	37⅝	....	....	....	....	....
80	95¼	89⅝	79⅝	40	50¾	45⅝	39⅝	....	....	....	....	....
82	97½	91⅞	81⅝	42	53	47⅞	41⅝	....	....	....	....	....
84	99¾	94⅛	83⅝	44	55¼	50⅛	43⅝	....	....	....	....	....
86	102	96⅜	85⅝	46	57¼	52⅛	45⅝	....	....	....	....	....
88	104¼	98⅝	87⅝	48	59½	54⅜	47⅝	....	....	....	....	....
90	106½	100⅞	89⅝	....	....	....	....	....	....	....	....	....
92	108¾	103⅛	91⅝	....	....	....	....	....	....	....	....	....
94	111	104⅞	93⅝	....	....	....	....	....	....	....	....	....
96	113¼	107⅛	95⅝	....	....	....	....	....	....	....	....	....
98	115½	109⅜	97⅝	....	....	....	....	....	....	....	....	....
100	117¾	111⅝	99⅝	....	....	....	....	....	....	....	....	....

All these are to be either *rising stem* or *non-rising stem,* except in the case of safety, back pressure, automatic stops, and non-return, back pressure, or pressure regulators. All the sizes under 6 in. can be either iron body or brass body. Above 6 in. they are all iron body but may be brass fitted.

TABLE 6. GASKETS FOR EXTRA HEAVY HYDRAULIC FERRO-STEEL FLANGED VALVES AND FITTINGS[1]

For Cold Water or Oil Working Pressures as Follows: 1½ to 2½ in. 1200 lb. Hydrostatic; 3 to 4 in. 1600 lb. Hydrostatic: 4½ to 12 in. 800 lb. Hydrostatc

Gaskets for Male and Female Joints

SIZE OF VALVE OR FITTING In.	INSIDE AND OUTSIDE DIAMETERS Each In.
1½	1½ x 3⅛
2	2 x 3⅝
2½	2½ x 4⅛
3	3 x 5
3½	3½ x 5½
4	4 x 6
4½	4½ x 6½
5	5 x 7¼
6	6 x 8⅜
7	7 x 9⅜
8	8 x 10⅝
9	9 x 11⅝
10	10 x 12¾
12	12 x 15¼

[1] Gaskets shall fit inside of bolt holes for lines not under vacuum. Vacuum lines shall have full face gaskets.

TABLE 7. GASKETS FOR EXTRA HEAVY HYDRAULIC CAST STEEL FLANGED VALVES AND FITTINGS[1]

For Cold Water or Oil Working Pressures up to 3000 lb. Hydrostatic

Gaskets for Male and Female Joints

SIZE OF VALVE OR FITTING In.	INSIDE AND OUTSIDE DIAMETERS Each In.
1½	1¼ x 2¼
2	1½ x 2¾
2½	2 x 3 9/16
3	2½ x 3 15/16
4	3 x 5
5	4 x 6 3/16
6	5 x 7¼

[1] Gaskets shall fit inside of bolt holes for lines not under vacuum. Vacuum lines shall have full face gaskets.

TABLE 8. GASKETS ON AMMONIA AND ACID SERVICE FOR TONGUE AND GROOVE JOINTS

Rubber—Lead

Size of Valve or Fitting—In.	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6	7	8	10	12
Outside Diameter of Gasket—In.	25/32	1 3/32	1 7/32	1 25/32	1 25/32	2 7/32	2 15/32	3 3/32	3 21/32	4 9/32	4 25/32	5 15/32	6 21/32	7 25/32	9⅝	10⅞	13⅛	15⅛
Inside Diameter of Gasket—In.	13/32	25/32	⅞	1⅛	1⅜	1 11/16	1 15/16	2 7/16	2 15/16	3 9/16	4 1/16	4 9/16	5⅝	6 11/16	8⅝	9⅝	11⅝	13⅝

TABLE 9. GASKETS FOR USE ON BOYLE JOINTS

RUBBER GASKETS

For Screw-Gland and Boyle Joints

Size of Valve Fitting—In	¼	⅜	½	¾	1	1¼	1½	2	2½	3	3½	4	5	6
Outside Diameter of Gasket—In.	1	1⅛	1¼	1½	1 13/16	2¼	2½	3⅛	3 11/16	4 5/16	4⅞	5½	6⅞	7⅞
Inside Diameter of Gasket—In.	9/16	11/16	13/16	1 1/16	1 11/32	1 11/16	1 15/16	2 7/16	2 15/32	3 9/16	4 1/16	4 9/16	5⅝	6 11/16
Thickness of Gasket—In.	¼	¼	¼	¼	¼	⅜	⅜	⅜	⅜	½	½	½	⅝	⅝

Every well-known manufacturer of valves has catalog lists of the kinds of valves given here, and the same lists are in the catalogs of supply houses for this class of goods. Every buyer wants to be sure of full weight in the valves he purchases, and will get it from any of the responsible manufacturers. There are some valves on the market which are light weight and the only way to avoid these is either to specify a well-known manufacture or full weight to correspond with American Society of Mechanical Engineers standard thickness of fittings.

Steel body valves are required for superheated steam service. On some acids, lead-lined valves are required and can be supplied, as well as lead-lined fittings and pipe. These are special and cost more.

Some manufacturers make a specialty of metal discs for their globe valves, some do not, but furnish a stock metal for all uses. The purchaser can have special metal discs by specifying them, but metal discs other than the stock furnished by the manufacturer with his valves will come extra.

The globe type of valve is more apt to be tight on the seat than the gate type. On the other hand, tight valves can be assured when wedge type gate valves are ordered.

When ordering flanged fittings, flanges, or flanged valves, always specify the bolt holes to be spot faced.

All valves 4 in. and over should be flanged. They should be so made as to pack under pressure. Packing for valve stems on piping should always be some form of spiral packing of various compositions for steam and water, and lead for ammonia or acids.

Tables 1-9 give gasket size and material for various services.

There was a time when the manufacturers of pipe fittings advocated the use of the welded header to be placed in pipe lines, to reduce the number of fittings and joints. There is much merit in the idea, and if the header can be made properly, it is good.

During the year 1923 the writer specified such headers and placed the order with one of our most reliable manufacturers. When the header was erected in place it was found to leak in every weld. The welding was performed by a pipe-welding concern long in the business. After the failure was apparent, all parties concerned stated that they would not guarantee any welded header.

With this experience in mind and knowing that responsible concerns in the business will not guarantee such work the reader is warned against accepting the idea of welded headers as practical.

Screw joints have been generally used in the past and are still in favor. The Vanstone joint is also in general use, its principle disadvantage being its increased cost over the screw type.

Flanges on pipes should have ends welded over on the inside to make a raised face inside of bolt holes, and the face must be machined for ring gaskets. Proper length bolts will be furnished for joint specified.

THE EDITORS' PAGE

Present-Day Trends

CERTAIN present-day trends in industry and business are so unmistakable that they cannot be neglected nor their effects ignored. Prominent among them are the lowering of prices of manufactured goods, and the lessening of the volume of demand. Their influence is radiating throughout all business relationships from the consumer to the retailer, from retailer to jobber, and back to the manufacturer. Under the resulting conditions, to conduct an industrial enterprise with profit, costs must be successfully reduced and output per unit of wages increased.

Howard Coonley succinctly sums up the true situation:

> Business will be done on a closer margin of profit and by larger individual units. The predominance of the small individual producer is past, and modern competition forces the efficiency and economies possible only to large organizations with far-spread merchandising units and with plants located so as to obtain the lowest cost of raw materials and labor and the most economical distribution of each separate line of product. Such far-flung activities require centralized control of the highest type—a control in which foresight and wisdom make up for the lack of that natural leadership which was possible under the early conditions.

The immediate effect of these economic causes is to place upon the management of industrial concerns an increased burden to make profitable operation certain. Every aspect and detail must now be analyzed to make sure that maximum result is secured from the corresponding outlay. All available knowledge must be searched and that which is applicable in a solution of vital problems must be utilized. Only by such means can progress be assured.

There are no factors which hold out the possibility of any immediate change in these present-day trends. In fact, many who are well acquainted with the operation of industry believe that lowering of prices will continue for a long period, perhaps a score of years. While this would seem to indicate a difficult operating condition for a long period, yet with it, is the assurance that as difficulties are overcome, industry and business will be strengthened and better able to conduct profitable operation.

The Matter of Hand-to-Mouth Buying

OF prime importance to the manufacture of consumer goods is the present dealer trend to small stocks and hand-to-mouth buying. Is it a general trend—is it temporary, or is it here to stay? And how can the manufacturer meet the situation?

As stated in a recent bulletin [1] of the National Bank of Commerce in New York, commenting upon the causes of the present business condition of "depressed uncertainty":

> A third and allied factor is the tendency which has become increasingly prevalent since 1921, of hand-to-mouth buying with stocks held at a minimum. Retailers and wholesalers unite in pushing back upon the manufacturer the risk of carrying goods. Stocks are kept low, orders are small and frequently repeated, and free use is made of cancellation. While this is a measure of safety to the distributor it naturally increases the nervousness of the manufacturer, who had become accustomed, in an era of rising prices, to a comfortable back log of forward orders.

This presents the situation very clearly. As to its permanency the bulletin does not hazard any long-range prediction, merely stating that "the prospect is for a continuation of careful buying". The matter is, however, taken up by Kenneth M. Goode, in the *Advertising and Selling Fortnightly,*[2] who argues that the present-day "prompt, swift, reliable delivery" has made hand-to-mouth buying possible, that the dealer has tried it and found it advantageous, and that it has come to stay.

As seen by this writer there are four causes which have brought about and will tend to make permanent this hand-to-mouth buying.

> 1. *The Downward Trend of Prices.* There seems little question that the world is in for a long cycle of gradually declining prices. The only way to repair the ravages of war is to go to work—and more work means more goods. More goods, in the long run, mean lower prices.

Obviously no intelligent dealer will purchase a heavy stock in the face of falling prices. The day when the buyer resumed control of the market is still too fresh in his memory to permit of that, even if elementary principles of economics did not forbid. Therefore hand-to-mouth buying will continue so long as falling prices characterize commodity markets.

> 2. *More Knowledge Among Customers.* American manufacturers, alternately swamped with orders and frenzied with cancelled contracts, have learned a good deal in the past few years. But their customers—the merchants—and their customers—the public—have learned a good deal more. The war broke down narrow horizons.
>
> Magazines, Sunday newspapers, moving pictures, radio, are the Paul Reveres of progress to every Middlesex village and farm.
>
> Few merchants, therefore, can afford to gamble on a big stock; the customers today know what the merchants don't: it is far easier to find out what they want and get it for them quick, than to find out slowly after the goods are ordered. And infinitely safer!

In addition to this outside influence is the growing knowledge of business on the part of the dealer himself.

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[1] Commerce Bulletin, May 1924.

[2] May 21, 1924.

> 3. *Better Business Direction Among Merchants.* Washington, with all its faults, has forced the American business man to learn something about his own business. In these days of high taxes and complicated tax returns, every one of us becomes either an expert accountant or a nervous wreck. Digging in his figures, the average merchant has discovered what the Wanamakers and Macys knew years ago: that it pays to take any trouble replenishing soldout spots on his counters rather than sit lazy under well-stocked shelves.
>
> Turnover, therefore, has at last crept into its own. Through excellent national organizations and splendid trade papers, merchants everywhere have finally learned that rapid turnover is fully as important as prices, sales, and profits. The excitement of trying to squeeze another stock turn or two in each department keeps many a merchant off the golf links—and out of the poorhouse.
>
> Quick turnover, however, is only the beginning of hand-to-mouth buying. The new method means not only small stocks, but well-selected stocks. Consciously or unconsciously, the swing toward "simplification" must inevitably descend from the wholesaler to his retail agent. . . .
>
> Even more important, however, than the other three causes together is the new era of transportation. Lowering prices, better storekeeping, style-informed customers, all make the merchant *want* to get along on thin stocks. But only prompt, swift, reliable delivery allows him to.
>
> Railroads plus motor trucks, and motor trucks versus railroads, have worked a revolution.
>
> The merchant today gets his goods delivered fast enough to follow the demand; he no longer has to guess.

Summarizing the situation from the standpoint of the dealer, Mr. Goode says:

> He lets radio and movie educate his customers instead of attempting it himself. He distributes his risk over half a dozen small purchases in a season instead of one big one. He turns over his stock several times more a year. He makes more money with less trouble and less risk; he most certainly will stick to hand-to-mouth buying.

As general conditions improve, dealers will doubtless carry larger stocks, but the advantages of small stocks with frequent replenishments are too real and too obvious to permit the dealer to go back to the heavy stocks of former days. The manufacturer must recognize this condition and resort to the intelligent and forward-looking planning that will alone enable him to meet the situation.

The Next Era of Industry

DEVELOPMENTS are projected in the United States which may bring another industrial revolution. The waters of our rivers can supply over 40,000,000 hp. to be used for the well-being of our people, and applications for the utilization of more than 20,000,000 hp. of this amount are now on file with the Federal Water Power Commission. At present we are generating about 60,000,000 hp., 10,000,000 from water and 50,000,000 from steam. The proportion of possible increase is therefore very high.

The terms super-power and giant-power have been applied broadly to this vast project. Briefly stated it proposes a single power system extending from the Atlantic to the Pacific, and the Great Lakes to the Gulf, receiving power from every water-fall, from huge steam plants in the coal regions, and from all other economic sources, and distributing the maximum of this available power to the largest number of our people at the lowest cost possible.

The general application of such a vast amount of inexpensive power would stimulate the development of every industry, increase the earnings of workers, decrease the cost of products, increase the efficiency of transportation, develop rural and small town districts, relieve the farmer of labor difficulties, lighten the work of the housekeeper—in fact usher in a new revolution in industry. In a single phrase, super-power will increase the standard of American living.

But, it is not sufficient merely to develop new power projects. To secure the greatest advantage they must be linked together into a great net-work to supply power to everyone, no matter where he may choose to live. To the advantage of nation-wide service is added flexibility in distribution. That is, electrical energy can be transferred from one point of lower demand to another of higher demand through a single power system. We have already had one instance of this kind referred to by Mr. Macy on page 663 of the June issue. He tells us that in 1922 when a water shortage resulted in North and South Carolina due to a prolonged drought, Alabama was able to supply electrical energy to the Carolinas because of the great interconnected power system of the Southeast section. This extends from Goldsboro, North Carolina, to Muscle Shoals, Alabama, a distance East and West of about 550 miles, and from Nashville, Tennessee, to Montgomery, Alabama, a distance North and South of about 250 miles.

The promise of these plans and projects is a power development during the next quarter century rivaling the railroad building which followed the Civil War and the manufacturing expansion of the immediate past.

The Heroic Figures of Management

AMONG the milestones of dates and events marking the progress of every human effort for better things, stand the heroic figures of those who dared to lead. Management is such a struggle of humanity, a great attempt to bring under control resources which must be utilized for the benefit of all. As a movement it has its markers of advancement; it has had its leaders of progress.

With the death of Frank B. Gilbreth, a fourth is added to the little group whose memory we revere, whose work we, who are in industry, have entered into, whose lives stand as beacons of inspiration.

Taylor, Dodge, Gantt, and now Gilbreth—because they lived the world of industry is richer, human comfort enlarged, and their surviving fellows have in a greater degree dominion over the earth. From their thinking has come the great vision of universal well-being erected upon the orderly operation of business and industry, to be realized through a maximum of articles and goods for human use!

Earning By Saving

"A PENNY saved is a penny got" is as true today as when it was written two centuries ago. Dividends resulting from economies are just as acceptable to stockholders as those from any other source. Profitable operation depends largely upon the elimination of waste—waste of men, of machines, and of materials.

The first two factors have received considerable attention in recent years. As a result of this, although many organizations may not be using the available information to the best advantage, there are well-defined methods, generally accepted by managements, that may be applied effectually to prevent excess waste of men or idleness of machines. Studies of the third factor have been confined, heretofore, almost entirely to methods of salvaging and utilizing material *after* it has become useless for ordinary production purposes.

C. B. Auel in an article appearing in this issue, and in a previous article which was published in the June issue, attacks the problem of eliminating wastage of materials from the standpoint of *prevention*. This is the only way to combat waste effectively. Regardless of the success with which salvage operations are performed, rarely is the salvaged value of material equal to its cost. Proper salvaging procedure will decrease losses from waste materials, but, to reduce loss from this source to a minimum, waste must be *prevented.*

The opportunities for attaining more economical operation, offered by this method of attack, are great; and Mr. Auel presents valuable suggestions for procedure based on experience in a plant that has carried on a successful campaign against waste. The methods discussed include standardization of the various materials used in factory operation. There are very few plants in which work of this nature would not result in considerable savings on the cost of materials.

As stated in the article the first thing to be done is to fix upon certain sizes and kinds of materials that fulfil the two requirements of suitability for their intended use, and economy in purchasing or manufacturing. The obvious method for accomplishing the second object would be to restrict materials to ordinary commercial and manufacturing standards. Such a course would accomplish considerable but, unless the manufacturers have given thought to and taken action toward simplifying their product, it is likely that the number of "standard" sizes and grades will greatly exceed the number really necessary. So the task of standardization involves careful selection, from commercial sizes and grades, those which have the widest range of utility in the production processes of the plant.

Standardization of materials alone will result in large savings, but if it is practiced in connection with simplification of the manufactured product the results may be increased manifold. Simplification means that, instead of satisfying every customer whim for special grades and sizes of product, only a few types, that include enough sizes and grades to satisfy every ordinary use requirement, are manufactured.

Simplification may be brought about in many different ways. Probably the most popular method is to accept as standard the types of product for which there is the most demand. Whatever method is used, simplification is possible and highly desirable from both a manufacturing and an economic standpoint. Simplification of product together with standardization of the materials entering into the product offer great opportunities for further economies in manufacturing process through elimination of waste. Mr. Auel's description of the work being done at Westinghouse is a valuable contribution to a subject which has received scant attention heretofore.

Equipment to the Front

LOSING one's perspective, or underrating or overrating a matter of particular interest, is a besetting temptation. It is fostered by the fashions of the moment and the publicity in regard to this or that development or trend. In the executive control of industrial enterprises it may be that this temptation has been yielded to during the past few years with the result that the importance of equipment in industrial operation has been somewhat overlooked.

To produce effectively, all of the agencies of production must be present and their harmonizing and direction is the task of the management. To single out any one above its fellows may be yielding to this same temptation of distorted perspective. Nevertheless, certain healthy signs indicate that the importance of industrial equipment and its effective operation are moving to the forefront in the minds of many men.

The possibility of major savings and thereby increased earnings of industrial concerns through the wise application of industrial equipment was brought home by the article in our April number by W. R. Basset. The interest which this article has attracted among our readers is evidence of the importance of such developments. This response is not surprising when the degree of savings is appreciated. In a foundry an installation of $33,000 worth of equipment improvements saved $21,000 per year in direct wages; a forge shop adding a simple shears to each power hammer saved 30 per cent in direct wages; in a small manufacturing concern the installation of labor-saving devices such as trucks, conveyors, a crane and a few other items of equipment brought a saving of $14,000 per year, or an increase in net profits of nearly 50 per cent; in a candy factory installing machinery to wrap and label peppermint candies saved the labor of 30 girls and reduced the weekly pay-roll $360.

In every case the decision to make these additions and changes came from the management. That is, the problem which was studied and solved was a responsibility of the management. These particular cases instead of being exceptions are typical, for under present conditions of business operation any permanent investment becomes a managemental responsibility. The obvious resulting situation is that a progressive management, composed of men who are keeping abreast of the times, taking advantage of every opportunity to save, will keep informed on all developments of industrial equipment which may be used with profit.

NEWS OF EQUIPMENT
FOR THE MANAGEMENT

This department is conducted to give our readers essential facts regarding items of industrial equipment recently placed on the market, that may be used to increase production or lower costs. Each item is indexed according to the Dewey Decimal System so that it can be accurately filed for future reference. The editors will be glad to furnish additional information about any item. All information given is obtained from reputable manufacturers, and Management and Administration accepts it as reliable.

Truck Crane

Index Number 658.281 Industrial trucks

A crane which may be mounted on an ordinary 5-ton truck for use in unloading cars, loading trucks or wagons, handling lumber, driving piles, excavating, or any other purpose for which a crane can be used, has been developed by Orton & Steinbrenner Co. It can handle logs or erect structural steel buildings. With a generating set it can operate a 36-in. magnet and handle scrap iron, pig iron, or castings. In fact, it can do anything an ordinary crane of the same capacity can do with the advantage of mobility which enables it to go anywhere a truck can go.

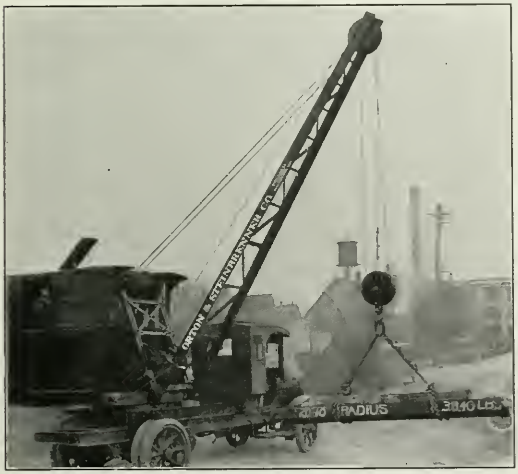

Fig. 1 Revolving Crane Mounted on Motor Truck

It can be mounted on any 5-ton truck that has a distance of 8 ft. or over from the back of the driver's seat to the center of the rear axle, and nearly all trucks meet this requirement. It is full revolving—can swing through a complete circle. The counterweight compartment can be emptied of its contents, usually sand, in order to lighten the apparatus for travel over bridges or roads having statutory load limits.

All operating levers are banked at one side in front so that the operator may have a clear view of the work at all times. All wearing surfaces are bushed with removable bronze bushings. The frictions for operating the hoisting drums are bronze cones with outside band brakes. All gears are steel; shafting is forged and turned; practically the entire structure is cast of structural steel; lubrication is by Alemite pressure system. The turntable is a steel casting revolving on 4 large steel rollers. The "A" frame supporting the boom is structural steel. Either a full steel cab, as illustrated, or a canopy with curtains can be furnished.

Power is furnished by a heavy duty, 4-cylinder Hercules motor, with 5 in. stroke, developing 37 hp. Motor accessories include Stromberg carburetor. Twin-Disc clutch, Perfex radiator, high tension magneto with impulse starter and 30 gal. gas tank. Double drums are furnished on the main drum shaft and power is supplied to both so that in bucket handling work the bucket may be hoisted either open or closed.

Electric Hand Drill

Index Number 621.95 Drills

A portable electric drill adapted for use in machine shops, erecting departments, or similar installations is being manufactured by the Standard Electric Tool Co. A bench stand can be furnished with the drill whereby it can be used interchangeably as a bench or hand drill. Also it can be furnished with an arbor for holding small emery wheels with which small castings, chisels, etc., may be ground.

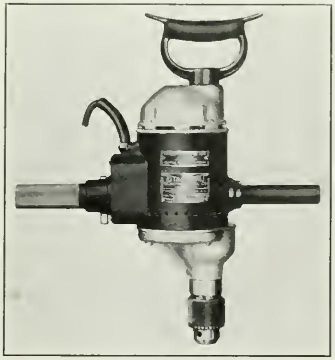

Fig. 1 Portable Electric Drill

The drill is fitted with ball-bearings each incased in a grease and rust-proof chamber. The chuck runs against a thrust bearing. Motive power is furnished by a Universal motor operating on either AC or DC current at a frequency of 60 cycles or less. It is series commutating type, insulated, and cooled by means of a high-speed fan.

The tool is made of 5 units each of which can be removed without disturbing electrical connections. The drill weighs 17 lb. and operates at a speed of 475 r.p.m.

Pipe Fittings

Index Number
621.774 Pipe fittings

STEEL or wrought iron pipe is used extensively for such structural work as racks, railings, bench or table frames, and frames for mounting electrical switching equipment. Westinghouse Electric and Manufacturing Company has developed a new line of pipe-fittings to be used in structural work. The principal feature of the design is a ribbed yoke which clamps over the pipe with carriage bolts. With this unit as a base a large number of fittings have been developed to meet nearly every requirement for structural work.

The fittings are of wrought iron with a minimum tensile strength of 50,000 lb. per sq. in. As the fittings are bolted up they yield slightly until they fit the pipe so tightly that the load necessary to slip a single fitting is in excess of 3000 lb. for a 1¼ in. pipe and 4500 lb. for a 2 in. pipe. The bolts used are ordinary carriage bolts with square shanks under the heads to fit in square holes in the fittings so that only one wrench is needed for assembly. Fittings are available for 1¼ in. and 2 in. pipe and for a combination of these sizes used in extensively braced structures, with a few fittings for ¾ in., 1 in. and 1½ in. pipes.

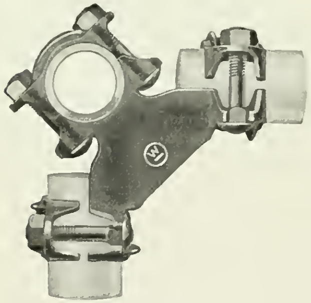

Fig. 1 Pipe Fitting for Structural Work

Ball Bearing Grinders

Index Number
621.92 Grinding machines

TWO new grinders have been developed by the Saint Louis Machine Tool Company. They are called the "Western" and the "Saint Louis".

The former has 1 set of ball bearings at each end, with felt retainers at each side of both bearings. The arbor is 13 in. long, ⅝ in. diameter between collars, and has square threads. It takes the same column, countershaft, and wheel guards and has the same dimensions as the same class babbitt bearing machines made by this company.

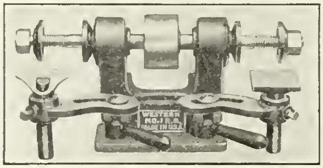

Fig. 1 "Western" Type Grinder

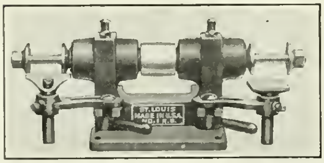

Fig. 2 "St. Louis" Type Grinder

The "Saint Louis" grinder differs from the "Western" in having 4 sets of ball bearings. This feature makes it an easy running, rigid machine. The arbor is 16 in. long and ⅝ in. diameter between collars. Like the "Western," the "Saint Louis" has the same dimensions as babbitt bearing machines of the same class.

These machines are adaptable for toolroom work or anywhere throughout the plant where a small grinder may be desired.

Seat Type Tructor

Index Number
658.281 Elevator truck

AN elevator tructor designed for the purpose of picking loads up from or placing them on the floor with little clearance between the floor and the supports is offered by the Elwell-Parker Electric Co. The elevator head at the forward end may be equipped with forks at the floor line, of proper spacing and length to handle sheet tin or steel plate, bales, boxes or barrels, and similar objects. It can be fitted with a pair of arms 18 in. above the floor to handle tote barrels as is shown in the accompanying illustration. Finally, it can be equipped with a single horizontal shaft for use in handling coils of wire, wheels, and objects of like nature.

The operator's seat is placed well forward so that he can more easily observe the operation of the elevator. All controls are within his reach from the seat. The hoisting unit consists of an enclosed motor, with electric brake, which drives a drum through a bevel and worm gear reduction unit. From the drum a ⅜ in. steel cable leads over sheaves at the top of the elevator uprights to the traveling elevator head which is provided with attachments to support the load handled. The elevator head is guided by 4 rollers running inside the uprights. The hoisting motor can be stopped automatically at the upper and lower limits of travel of the elevator or its movement can be controlled manually.

The overall length of the unit, without load lifting attachment, is 78 in., its height 70 in., its width 38 in., and its weight including battery is 4300 lb. All 4 wheels are equipped with 7 in. double row ball-bearings and 20 in. by 3½ in. tires. A pressure greasing system is used for lubrication.

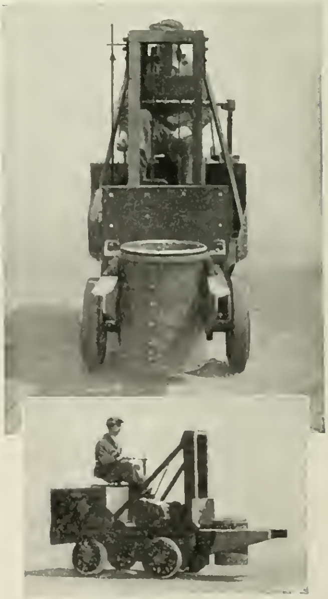

Fig. 1 Electric Industrial Tructor

Static Condenser

Index Number
621.31564 Static
condensers

A STATIC condenser designed to improve the power factor of the circuit, thereby increasing the available capacity of generators and transformers, decreasing energy losses in distribution systems and improving voltage regulation thus increasing the supply of power, is being marketed by the General Electric Company.

It consists of a number of condenser units, a reactance for dampening out the higher harmonics in the voltage wave, a discharge resistance for draining the condenser charge when disconnected from the line, and an oil circuit breaker for control purposes. No attendant is required; the condenser is placed in operation by closing a control switch, and can be left on the line indefinitely with but occasional inspection. Operation is practically noiseless, and since there are no moving parts no special foundation is required. Condensers may be designed for indoor or outdoor installation.

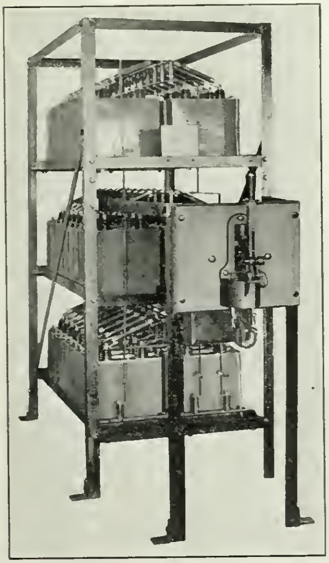

Fig. 1 Static Condenser

They are sold in standardized capacities for from 40 to 125 cycle circuits, 220 to 2300 volts, in 6 sizes from 30 to 300 kva. For larger capacities complete units are arranged in tiers. Weights without reactor, or transformer furnished with low voltage equipments, range from 800 lb. for the 30 kva. size to 5000 lb. for the 300 kva. size.

Vacuum Pump

Index Number
621.64 Vacuum
pumps

THE Crescent Roto Piston Dry Vacuum pump that is being distributed by the Chicago Pneumatic Tool Company has two main moving members—a rotor or piston and case which revolve about a fixed shaft at the same angular velocity. The rotor, being smaller in circumference than the case and set off-center to the case axis, is given a rolling motion as it describes each revolution. This movement maintains a displacement of fixed capacity which is at all times divided, by the brass rotor vane, into intake and exhaust spaces, and which changes from zero to maximum volume throughout each pumping revolution.

The manufacturers state that the absence of clearance spaces and valves eliminates unproductive capacity, and provides a volumetric efficiency approximately 99 per cent in exhausting to within ½ in. of the barometer. Working parts, ball-bearings, and bronze bushings are lubricated with oil by a force feed system.

Its small size permits its installation in limited spaces where it can be driven from a line shaft or electric motor, either direct connected or with a belt drive. It can be used to operate evaporators or dryers, to provide high vacua for vacuum chucks in machine shops or for other installations which require a vacuum in their operation.

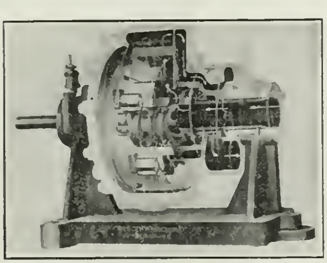

Fig. 1 Crescent Vacuum Pump

Machine Turnings Crusher

Index Number
658.567 Waste
treatment

THE handling, storing, and disposal of turnings as they come from machine tools has always been a difficult problem to solve. They could only be handled with forks, and not easily then; because the space occupied was so much greater in proportion to their weight, storing large quantities usually was uneconomical; and a freight car could not be loaded to its weight capacity, thus involving excess transportation charges. A machine for reducing loose, bushy, metal turnings, to small chips has been developed by the American Crusher and Machinery Corporation.

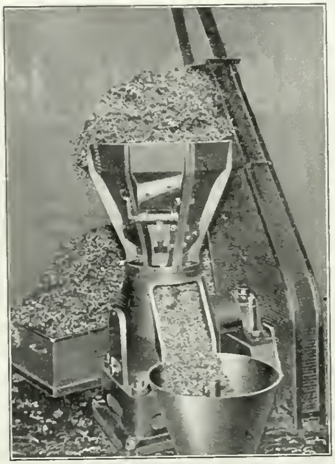

Fig. 1 Machine for Crushing Metal Turnings

By means of this machine the turnings can be reduced to chips of any size desired, occupying only about 1/15 the space required for loose turnings which permits a saving in storage space and transportation costs. Chips can be handled by shovels or conveyors. The capacity of oil-separators is increased by the use of chips with a possibility of more of the oil being recovered. Where several metals are used, the process of crushing permits iron and steel chips to be separated from other metals because of its magnetic properties.

The machine consists of a hopper into which turnings are thrown; a revolving cutter head which pulls them down to be cut between revolving knives in the cutter head and fixed knives on the wall of the machine; and a rotating knife head which makes the final reduction on the turnings. Safety devices automatically stop the machine should a solid piece of scrap, a tool, or similar object, be thrown in hopper with the scrap. The only parts subject to wear are the hardened steel knives which may be removed and replaced.

Two sizes of crushers are made. The smaller has a capacity of about ½ ton an hr., requires 4 hp., and can be furnished for belt drive or self-contained motor drive. The larger has a capacity of about 5 tons per hr., requires 15 hp., and can be furnished for belt drive only.

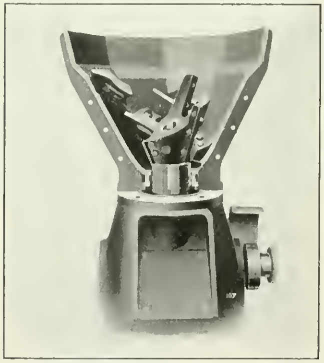

Fig. 2 Detail of Knife Mechanism

Blue-Print Drying Machine

Index Number
778.1 Blue-printing

A NEW blue-print drying machine is being marketed by Hamilton Engineering Service, Limited. The drum is a smoothly finished cylinder mounted on self-aligning ball-bearings and can be heated by electricity, gas, or steam. The drive is disc-type direct connected to the motor with worm and worm wheel for speed reduction.

An endless apron is carried on a series of steel rollers arranged to bring a heavy pressure on the prints as they pass around the heated drum, thus ironing as well as drying them. The machine is provided with a drip pan to prevent water from falling on the floor. Strippers separate the dry prints from the drum and guide them to the sorting tables at the rear of the machine.

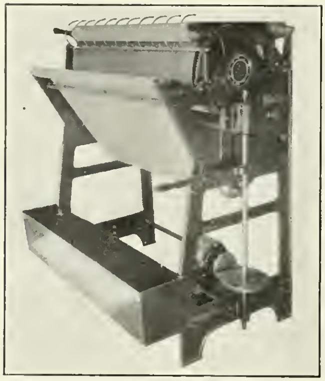

Fig. 1 Blue-Print Drying Machine

They can be furnished in 2 widths, 42 and 54 in. weighing, packed, about 700 and 800 lb. respectively. Any length print can be handled.

Air Drill

Index Number
621.95 Drills

PRODUCTION under modern shop practice, particularly where piece work prevails, demands of a portable air drill for reaming purposes, ability to handle work varying from a single plate to a number of plates and gussets, with forgings, gray iron, or steel castings interspersed among them; all of which produces a constantly changing power factor. With these requirements in mind the Chicago Pneumatic Tool Company has developed the Red Giant Drill.

The Red Giant weighs 35 lb. and is well balanced so it is easy to handle and control. Some of its structural details are: double-acting pistons and cylinders; eccentrics, forged integral with crankshaft; balance piston type valves; forged nickel steel crank-shaft mounted on 3 ball-bearings and stub tooth type crank pinion and ball gear; splash lubrication.

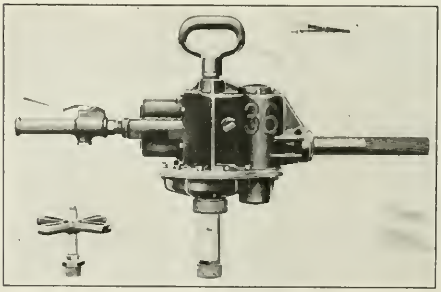

Fig. 1 Air Drill for Reaming

Self-Lubricating Bearing

Index Number
658.281 Lubricating devices

FOR use particularly in applications where cleanliness is required, where oiling is difficult or dangerous, or where oiling is apt to be neglected, the Universal Self-Lubricating Bearing Corporation is marketing a babbitt reinforced self-lubricating bearing. It consists of a maple shell in which grooves have been tooled to receive and hold a cast core of babbitt metal. The shell, which is impregnated with lubricant, serves the purpose of an oil reservoir.

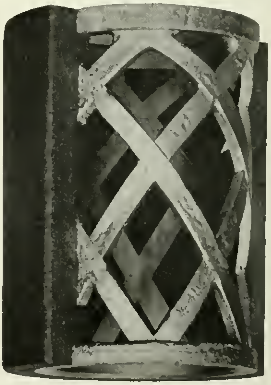

Fig. 1 Self-Lubricating Bearing

After installation the bearings require no attention, do not spatter or drop oil, and are not affected by atmospheric conditions. They can be furnished in all standard sizes with the design of the bearing, and the composition of the lubricant adapted to the particular service for which it is intended.

CURRENT INFORMATION INDEX
FOR THE MANAGEMENT

The material indexed in this department is selected by the editors of MANAGEMENT AND ADMINISTRATION from upwards of 150 magazines; it also includes the publications of some 50 book publishers and professional societies as far as these are of managerial interest to industrial executives. The items are prepared and classified by the Engineering Societies Library in New York City. The decimal number at the right of each item is the index number and indicates the place the article or book will take when filed in accordance therewith in the classified subject scheme. If articles are grouped according to these numbers like subjects will automatically fall together and related subjects will follow in logical sequence. Photostat copies of any magazine article indexed can be supplied by The Ronald Press Company for a moderate charge. The books and pamphlets indexed can be procured from their respective publishers.

Accounting

Distribution of Overhead to Jobs. 657.441
G. C. Brown. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 683-688. Simple methods that may be applied in a small factory.

Foundry Cost System. 657.452
National Association of Cost Accountants. *Official Publications.* May 15, 1924, v. 5, no. 17, 12 pp. System outlined was arranged primarily for iron foundries producing castings of varied designs and weight. Principles are applicable to brass, malleable and steel foundries.

Getting at Costs by the "Point Method". 657.452
R. E. Roesler. *Factory.* May 1924, v. 32, pp. 662-663. A cost method of interest to all who fabricate.

Methods of Supplying Cost Information to Foremen. 657.452
National Association of Cost Accountants. *Official Publications.* June 2, 1924, v. 5, no. 18, 8 pp. Problems involved and valuable results obtained from real co-operation with the foreman. Discusses direct and indirect costs, cost accounts, and cost records.

New Forms of Depreciation Schedules. 657.421
G. W. Greenwood. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 689-692. A new method of crediting depreciation. Current methods are outlined for comparison.

Preventing Losses in Repair Work. 657.452
Henry M. Burke. *Textile World,* May 10, 1924, v. 65, pp. 61, 63, 65. Charts. Method of cost finding that cuts red tape. Weekly bills sent to department heads to insure performance of work. Cost data is used as well as filed.

The Production Engineer. 657.452
A. Whitehead. *Mechanical World* (London) May 2, 1924, v. 75, pp. 274-275. Problems of correctly estimating costs of different methods of producing a given result. Analysis all that must be considered.

Tabloid Business Library. 657
Edited by Nelson H. Prouty. International Textbook Co., Scranton, Pa., 5 vols. $1.25 per vol. $5.00 set. Set is composed of 5 volumes, pocket size, containing from 35 to 55 pages each. Titles are: "How to Sell Your Services," by William H. Fletcher; "Special Accounting Examinations and Reports," "Financial Calculations," and "Coaching for C. P. A. Examinations," all by Stuart Chase, C. P. A., and "Audit Procedure," by Charles J. Nasmyth, C. P. A. The books are written in the handbook style of condensing facts into a small space and should prove useful as reference books to practicing accountants or others interested in the subjects discussed.

Advertising

Advertising as an Investment for the Gear Manufacturer. 659.1
J. C. McQuiston. *Western Machinery World,* May 1924, v. 15, pp. 153-154, 168. Value of advertising and how records of cost and profit may be estimated.

Advertising Copy. 659.1
G. B. Hotchkiss. 458 pp. Harper Bros. New York. $3.50. "Is a treatise on the art of writing advertising messages, considered as a branch of English Composition." The author believes that copy is the most important part of an advertisement—the part upon which the final result of the advertisement depends—and that the art of preparing it has been rather neglected heretofore. Although other phases of advertising are touched on occasionally, the main purpose of the book has been to point the way to a better and more effective use of English in preparing the copy. The author has had a number of years' experience in teaching English composition, and he is also head of the Advertising and Marketing Department of New York University. There is ample proof that he thoroughly understands his subject and the result of his efforts is a valuable contribution to advertising literature. The book was written primarily for students and newcomers in the advertising field, but the subject is discussed so thoroughly that it should prove of considerable value to anyone interested in it.

Bigger Results from Advertising. 659.1
Part 2. Finding the Best Way to Key Advertisements. Harold Herd. *Business Organization and Management,* May 1924, v. 10, pp. 122-126. Various systems of tracing returns by mail, as a means of determining the selling power of particular advertisements.

The New Information. 659.1
Stanley Resor. *Printers' Ink,* May 22, 1924, v. 127, no. 8, pp. 109-112. Importance of the advertising agency in studying public and markets and in supplying information about merchandise to manufacturer and public.

Buildings and Equipment

Better Illumination Without More Lamps. 658.24
W. Wendelken. *Industrial Engineer,* May 1924, v. 82, pp. 225-229. Illus. White paint on walls and ceilings will improve lighting and decrease wattage.

L'Eclairage des Locaux Industriels et Commerciaux. 658.242
J. Lynn. *Le Genie Civil,* May 3, 1924, v. 84, pp. 417-420. Artificial light, its influence on vision, fatigue caused by poor lighting, importance of wall finish, reflectors, choice of proper lamps, etc.

Illumination as a Factor in Shop Morale and Efficiency. 658.24
Railway Review. May 3, 1924, v. 74, pp. 815-818. Includes 14 rules governing use of light, taken from an address before the National Safety Council, January 1924, by Dr. Charles Sheard.

Increasing Production by Good Lighting. 658.24
Fred. L. Prentiss. *Iron Age,* May 8, 1924, v. 113, pp. 1343-1344. Tests made at Columbus, Ohio, plant of Timken Roller Bearing Co. Production increased 12.35 per cent under favorable lighting.

Insulation and Heating Possibilities in Buildings. 658.25
James Govan. *The Engineering Journal,* May 1924, v. 7, pp. 231-241. Illus. Results of observations and investigations of advantages of proper building insulation. Includes charts illustrating heat requirement and heat loss summaries of tests and experiments. Insulation materials are discussed.

Modern Maintenance of Plant and Equipment. 658.239
W. G. Ziegler. *Industrial Management* (N. Y.), June 1924, v. 67, pp. 369-374. Illus. Sanitation maintenance from the viewpoint of production and labor turnover.

The Increasing Use of Concrete in Factory Construction. 693.5
H. Colin Campbell. *Industrial Manage-*

ment (N. Y. , June 1924, v. 67, pp. 356-362. Illus. Concrete, its qualifications and their importance from an economic viewpoint.

Buying—Storeskeeping

Burlington Stores Department at Havelock, Nebraska. 658.78
Railway Review, May 3, 1924, v. 74, pp. 701-706: Illus. Large reclamation plant and concrete products plant operated in conjunction with stores department. Emphasis is given to unit piling system.

Does it Pay to Take an Annual Physical Inventory? 658.787
H. B. Freeman. *Factory*, May 1924, v. 32, pp. 666-668. Charts. A perpetual inventory that can meet the test of actual physical inventory twice a year.

Hand-to-Mouth Buying Brings Upheaval in Sales Tatics. 658.784
Eugenie Whitmore. *Sales Management*, May 1924, v. 6, pp. 943-944. Tendency to buy in small quantities for immediate use necessitates warehousing of stocks in strategic centers by manufacturers. Advantages of plan.

Material Handling Problems Encountered in the Assembly of Automobiles. 658.78
M. R. Denison. *Mechanical Engineering*, June 1924, v. 46, pp. 339-342. Description of time- and labor-saving methods devised for handling and inspection of raw materials and finished parts in an automobile manufacturing plant.

Purchasing Skill Builds Profit. 658.7
E. C. Kreutzberg. *Iron Trade Review*, May 15, 1924, v. 74, pp. 1297-1299, 1304. Value of purchasing agent to prosperity of plant and recognition that should be accorded him. Mastery of fundamental business conditions essential to the job.

Quantity Control of Inventories. 658.78
E. K. Wennerlund. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 677-682. Charts. Physical regulation contrasted with mere financial information. Illustrated with record cards.

Securing Efficiency in the Buying Department. 658.7
Eric N. Simons. *Business Organization and Management*, May 1924, v. 10, pp. 97-103. Methods adopted in a centralized buying department. Analysis of requisitions, recording, and following up orders, compiling statistics, etc.

Economics

Administrative Justice. 34
R. H. Smith. *Monthly Labor Review*, May 1924, v. 18, pp. 13-22. Discusses the encroachment of administrative methods of adjudicating controversies into the field of traditional common law systems.

Basis for Thriving Labor and Factories. 331.889
Noel Sargent. *Brick and Clay Record*, May 13, 1924, v. 64, pp. 728-733. Historic and present-day examples on subject of open and closed shop conditions.

The Foreign Market for Electrical Goods. 621.3:38
World Power, May 1924, v. 1, pp. 264-273. Charts. Statistical survey of exports during 1923, including comparisons with other countries.

Fragen der Zoll- und Handelspolitik. 38(43)
K. Lange. *Maschinenbau*, May 6, 1924, v. 3, pp. 541-544. Tariff and trade legislation in Germany and other countries. Discusses increasing need of importing food and raw materials and the necessity of regulation.

A History of Currency in the United States. 332.4
A. Barton Hepburn. 573 pp. The Macmillan Co., New York. $3. Forms a very complete reference on the history of money and finance in this country from the adoption of the constitution to the present time. All important bank legislation and currency reform movements are discussed in considerable detail. It commences with a general discussion of historical forms of currency and early continental forms. Then follows a story of the first attempts of the new republic to establish a coinage system; the increasing use of paper currency during the early part of the nineteenth century; the birth of a national banking system in 1861 and its subsequent growth; the silver contest of 1896; adoption of gold standard in 1900; and the Federal Reserve Act in 1913. The book is well written in an entertaining manner, and provides valuable information concerning the history behind our present banking and currency systems.

Industrie, Handel und Landwirtschaft Italiens unter dem Einfluss seiner Maschineneinfuhr-Beschränkungen. 38(45)
Raimund Armbrecht. *Machinenbau*, May 6, 1924, v. 3, pp. 546-547. Italian metal industry: its war-time growth, overproduction, the result of peace, and its tariff.

Industry's New Moral Perception. 174
Herbert Hoover. *Michigan Manufacturer and Financial Record*, May 17, 1924, v. 33, pp. 2, 26. Methods by which business can develop and enforce its own ethical standards and thus stem the tide of governmental regulations.

Mexico as an Industrial Nation. 38(72)
Hector Lazo. *The Pan American Union*, May 1924, v. 58, pp. 445-459. Descriptive and statistical survey of industries and manufactures, including textiles, furniture, shoe manufacture, sugar industry, etc.

Our American System of Weights and Measures. 389
64 pp. American Institute of Weights and Measures. Contains arguments, stated in non-technical language, why the present system of weights and measures used in this country should not be changed. The idea of making the metric system legal standard is considered very unwise.

Power Supply of Southern Industry. 38(75)
R. G. Macy. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 663-668. Power problem of Piedmont section of the Carolinas due to its rapid industrial growth. Map of the Southern super-power transmission system.

Unemployment. 331.13
W. A. Appleton, 157 pp. Hodder & Stoughton, London. One shilling. Since the close of the World War, England has been faced with a great unemployment problem. All sorts of remedies have been proposed, not a few have been tried, yet the number of unemployed still remains surprisingly large. Mr. Appleton reviews the situation in a way which reveals knowledge of his subject. He emphasizes the principle that unemployment is caused by numerous factors in combination and so there can be no single act that will stop it. Among the proposals which have been offered as solutions of the problem he finds few that can be termed preventative measures, but a great many that are temporary expedients proposed to alleviate the present condition with little regard for preventing its recurrence. Inasmuch as he does not believe that any one act, such as adopting unemployment insurance or a policy of emigration, will solve the problem he does not offer any precise method of cure. Numerous palliatives, underlying causes of unemployment, possible remedies and preventatives, are discussed in a way to furnish valuable information to anyone interested in the subject.

Unemployment: Its Cause and Cure. 331.13
Alfred Hook. 214 pp. The Labour Publishing Company, London. 5 shillings. The author defines "unemployment," not as mere "worklessness," but as a lack of opportunity to work through a standard day, in the production of normal needs of the community. "Employment thus means labour in production for service. Production for individual profit implies the use of some or all the profit in unproductive ways." Mr. Hook places a large share of the blame for unemployment on the capitalistic system which has arisen from increasing use of machinery. He believes that industry run for private profit must involve unemployment: as a permanent condition with labor displaced by machinery; as a periodic condition resulting from expansion and contraction of industry; and as a permanent condition arising from international machine competition. "Capitalism breeds profit; profit breeds an unproductive class; an unproductive class breeds unemployment among productive workers." Among the remedies offered may be mentioned community ownership of land and transportation systems, development of agriculture, and a system of variable working time to diminish periodical unemployment. Although many of his readers will agree neither with his premises nor his conclusions, all should gain a better understanding of the basic problems of unemployment after reading the many interesting and instructive things Mr. Hook has to say on the subject.

Die Wirtschaftsnöte der deutschen Industrie. 38(43)

Hillman. *Maschinenbau,* May 6, 1924, v. 3, pp. 537-541. Problem of reconstructing German industrial life. Urges maximum production and greatest possible economy, and draws encouragement from recent decreases in unemployment.

Financial Control

Mechanics of Profit-Making. 658.14

Park Mathewson. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 659-661. Charts. Finance management and its relation to sales, production and business administration and growth.

Protection of Working Capital. 658.14

J. H. Bliss. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 653-658. How surplus may be protected and improper dividends avoided by means of specific reservations from profits or free surplus.

The Relationship Between Books and Costs. 658.14

N. A. Hall. *Industrial Management* (N. Y.), June 1924, v. 67, pp. 325-328. Nontechnical discussion on what constitutes "cost," with explanatory comments on accounting words and phrases, and other helpful suggestions.

Seven Guides to Sound Financing. 658.14

G. D. Gaw. *System,* June 1924, v. 45, pp. 796-799, 832. Illus. How the Gaw-O'Hara Envelope Company built up business, established credit, without outside capital.

Fuel

Air as a Factor in Industrial Oil Burning. 662.75

W. G. Barstow. *Forging-Stamping-Heat Treating,* May 1924, v. 10, pp. 203-205. Atomizing by low-pressure air is shown to be efficient and economical.

The Combustion of Pulverized Coal. 662.65

E. Audibert. *Colliery Guardian,* 1924, May 9, pp. 1188-9; May 16, pp. 1251-2. Diag. Charts. Research on duration of combustion and burning conditions for various coals. Discusses experimental arrangements, inflammation of dust clouds, and the combustion chamber.

The Heat Balance of a Gas-Fired Enameling Furnace. 662.76

L. E. Biemiller. *Gas Age Record,* May 3, 1924, v. 53, pp. 621-622, 626. Illus. Operating results and some comparisons of production with furnaces utilizing other fuels.

Recovering Unburned Fuel and Other Matters from Ash. 662.6

C. H. S. Tupholme. *Gas Age Record,* May 17, 1924, v. 53, pp. 679-682. Illus. Separator actuated by difference in specific gravity between coke and clinker. Drawing and detailed description are given.

Requirements for Burning Pulverized Coal. 662.65

S. C. Martin. *Power Plant Engineering,* May 15, 1924, v. 28, pp. 525-526. Dryness, thorough pulverization, good air mixture, and other conditions necessary to secure maximum efficiency from pulverized coal.

Some Aspects of the Problem of Fuel Economy. 662.6

R. H. Aishton. *Railway Review,* May 31, 1924, v. 74, pp. 963-965. How to obtain better results with tools and appliances at hand. Co-operation of operating departments necessary.

Unit System for Pulverized Coal. 662.65

S. C. Martin. *Power Plant Engineering,* May 1, 1924, v. 28, pp. 471-472. Brief description of equipment for direct system. Gives results of efficiency tests made on installations in steam power plants.

Management of Special Industries

Les Ateliers de Réparations du Matériel Roulant. 658.9:625.2

Le Genie Civil, May 10, 1924, v. 84, pp. 441-445. Illus. Description of the operation of various services in central repair shop of London underground railways at Acton.

B. R. & P. Has Well Organized Production Shop. 658.9:625.2

Railway Mechanical Engineer, May 1924, v. 98, pp. 295-299. Illus. Results obtained in maintenance and equipment departments, through application of management and organization of personnel. Floor plans of shops are given.

Box Cars Rebuilt in Record Time. 658.9:625.2

Delaware & Hudson Co. *Railway Review,* May 24, 1924, v. 74, pp. 913-921. Illus. Drawings. Account of recent contest together with a description of the methods used in conducting contests.

Building Tractors under Scientific Management. 658.9:629.113

G. D. Babcock. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 647-652. Methods by which Holt Manufacturing Company has made a remarkable production record.

The Human Factor in Paper Manufacture. 658.9:676

E. J. McDonnell, *Paper Trade Journal,* May 1, 1924, v. 78, pp. 42, 44, 66. Why men who actually make the paper should be given opportunity to know and take part in discussion of problems, and should have a chance for advancement.

K. C. S. Makes Class 3 Repairs Within Eight Hours. 658.9:625.2

Railway Mechanical Engineer, May 1924, v. 98, pp. 301-302. Illus. Shows possibilities of modern facilities. Favors separation of repairs and erection.

The Operation of a Brass Foundry under Scientific Control. 658.9:621.72

F. W. Rowe. *The Metal Industry* (London), v. 24, 1924, April 18, pp. 373-374; April 25, pp. 395-398. Charts. Management engineering applied in the brass foundry. Charts are given. Discussion follows paper.

The Relation of Mechanical Engineering to Management in the Textile Industry. 658.9:677

E. H. McKitterick. *Mechanical Engineering,* June 1924, v. 46, pp. 343-344, 359. Opportunities of mechanical engineer to reduce manufacturing costs by means of improvements in power, lighting, and heating systems, and in handling of goods between processes.

Surveys New York Metal Group. 658.1

Iron Trade Review, May 8, 1924, v. 74, pp. 1238-1240. Growth and trend of industry in the city and environs with map showing location of plants. Importance as consuming center rather than producer is emphasized.

Unique Car Building Contest on the Boston and Albany R. R. Co. 658.9:625.2

Railway Mechanical Engineer, May 1924, v. 98, pp. 282-284. Illus. Two crews complete box cars in 94 man-hours each. Describes shop and length of time for each operation.

Mechanical Handling

Handling Material in Painting Department. 658.281:672.94

E. T. Bennington. *Iron Age,* May 15, 1924, v. 113, pp. 1413-1416. Illus. Overhead tramways and special dipping elevators, used by manufacturers of metal furniture.

Materials Handling Methods that Have Added to Industrial Profits. 658.281

G. E. Hagemann. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 693-694. Two specific records of cost of operations and savings in use of a 15-ton Brownhoist crane and a Link-Belt conveyor.

Special Trucks Real Safety Devices. 658.281

A. L. Lewis. *Iron Trade Review,* May 8, 1924, v. 74, pp. 1240-1241. Illus. Lift and stacking trucks; how they are built and operated.

Speeding Industrial Progress. 658.281

M. W. Potts. *Industrial Management* (N. Y.), June 1924, v. 67, pp. 348-355. Illus. Discusses all kinds of mechanical handling devices, cranes, belt- and power-conveyors, elevators, etc.

Zeitstudien und Bandarbeit. 658.281

Ewald Sachsenberg. *Maschinenbau.* April 10, 1924, v. 3, pp. 433-439. Illus. Lecture illustrating value of the continuous conveyor to increase production. A careful exposition of American methods of assembling.

Office Methods

Exporting Hints. 651.7

A. J. Smith. *Gas Age Record,* May 31, 1924, v. 53, pp. 776, 780. Overcoming the foreign language difficulty in correspondence by mechanical means. Code proved successful in exporting office.

Handling Callers in the Business Office. 651.45

By Helen Hysell. 106 pp. The Purchasing Agent Co., New York, $1.50. The reception clerk of a business office is in a position to create or lose the good-will of callers as well as to save valuable time for the executives of the organization. Often little thought is given to the selection and training of the receiving clerk with the result that executive time is lost in unnecessary interviews, callers are turned away in a tactless or even discourteous manner, and the general impression of the organization gained by visitors is unpleasant, although often unjustified by anything save their treatment in the reception room. In this book the author discusses the functions of the reception clerk and the proper attitude he or, in most cases, she, should take toward callers. Situations arising from the attitudes of various types of callers as well as those of the executives whom the callers wish to see are considered in detail and, so far as possible, general rules of procedure which will result in satisfaction to both parties are outlined. It is an interesting and instructive book on a subject which is too often neglected.

Making Business Letters Talk. 651.7
By Sherman Perry. 176 pp. The American Rolling Mill Co., Middletown, O. $1.25. A practical, instructive handbook on business-letter writing. It discusses grammar, spelling, make-up of letters, punctuation, and the principles to be observed in actually writing a letter, that it may gain the favorable attention of the reader. Nearly every rule given is illustrated by specimen sentences, which adds materially to the clearness and interest of the book. It should prove valuable to all who dictate letters as well as to stenographers.

Mechanical Accounting. 651.26
F. A. Brine. *The Gas Industry*, May 1924, v. 24, pp. 149-152. Mechanical equipment used in connection with accounting by Georgia Railway and Power Company: addressographs, adding machines, etc.

Organizing the Inward Mail Department. 651.457
P. E. Wilson. *Business Organization and Management*, May 1924, v. 10, pp. 127-130. Useful hints as to opening mail, dealing with enclosures, credit accounts, detection of omissions, etc.

Saving $10,000 a Year in Handling Office Mail. 651.457
D. C. Pettibone. *System*, June 1924, v. 45, pp. 768-771, 839. How postage may be saved by consolidating mail sent by different departments of one firm to similar departments of another firm. Experience of Northern Pacific Railroad Company is related.

Standard Forms for Office and Shop Use. 651.71
Management and Administration, June 1924, v. 7, pp. 695-698. Selection of paper for office forms and efforts made toward standardization. Size tables for standard forms are given.

The Tickler System for Offices. 651.57
Elton Johnson. *The Canadian Manufacturer*, May 1924, v. 44, pp. 32, 33. Illus. Memory aided by written memorandums. Forms used by various executives are given.

A Workable Production Control Plan for the Small Plant. 651.5
A. A. Dobson. *Factory*, May 1924, v. 32, pp. 652-654. Illus. The record part of control: office forms used and recording machines necessary to obtain best results.

Personnel

Caring for the Employees' Welfare at the Factory of William Wrigley, Jr. 658.382
The Canadian Manufacturer, May 1924, v. 44, pp. 29-31. Illus. Employees have their own cafeteria, recreation rooms, library, first-aid room, etc.

Fundamentals of Vocational Psychology. 658.3115
By Charles H. Griffiths. 372 pp. The Macmillan Co., New York. $2.50. An ever-increasing number of present-day business men are devoting attention to the selection of their employees by some more or less scientific method which will determine the adaptability of each prospect for the job he is seeking. In this determination psychology plays an important rôle. This book is a discussion of that subject in its adaptation to industry. It was written as a textbook and, consequently, the author has considered it advisable to stress principles and methods rather than their particular applications. To the employment manager or vocational counselor, however, this is of real value, for it is true that regardless of their successful practice a knowledge of the principles underlying their practice will be beneficial to them in their work. Considerable space is given to a discussion of various types of tests, both mental and physical. This is not for the purpose of giving the mechanics of applying tests, but rather to show the care and training which is necessary for their proper use and the relative accuracy of the results that may be obtained when they are applied correctly.

Hours of Work and Output. 658.3811
Otto Lipmann. *International Labour Review*, April 1924, v. 9, pp. 481-504. Economic aspect of eight-hour day. Solution of problem of increasing output is to be found rather in increased intensity of work than in change of working hours.

The Human Factor in Paper Manufacture. 658.3
E. J. McDonnell. *Paper Trade Journal*, May 1, 1924, v. 78, pp. 42, 44, 66. See Management in Special Industries.

Intelligence Test Scores and Business Success. 658.31156
W. V. Bingham and W. T. Davis. *Journal of Applied Psychology*, March 1924, v. 8, pp. 1-22. One hundred and two business men attending Babson Statistical Conference at Wellesley Hills took the Bureau of Personnel Research Test VI. Group included salesmen, sales managers and executives. Result of tests analyzed.

Labour and Co-partnership. 658.3174
W. Howard Hazell. *Business Organization and Management*, May 1924, v. 10, pp. 107-110. How workers in Hazell, Watson & Viney Co. share in profits of the company by buying "employees shares".

Menschenwirtschaft. 658.3
Adolf Friedrich. *Zeitschrift Vereines Deutscher Ingenieure*, April 26, 1924, v. 68, pp. 405-413. Problems of personnel management. Dignity of labor and human desire for progress must be accepted and utilized that it may benefit individual as well as management. Discusses practical problems, such as motion study.

A Merchant's Horizon. 658.3151
By A. Lincoln Filene. 266 pp. Houghton Mifflin Co., New York. $2.50. The author is one of the owners of a well-known store in which considerable progress has been made in the installation of modern methods of management. Particular emphasis is placed on the relations with the working force, which is of interest to managements everywhere. Contrary to conditions found in some industries, Mr. Filene's employees will not accept anything even approaching paternalism. The employees, themselves, manage their own benefit societies, restaurants, library, loan funds, etc., the employers being "privileged to help out" only when some unforeseen obstacle is encountered. From his own experience and from the result of a questionnaire circulated among the employees the author does not think that workers in general are ready or willing to accept a real voice in the management of an enterprise. He believes that at present they are interested only in those phases of management which are of personal interest; but increased interest and participation in management are desirable and must be obtained by educating the workers to the point where they see their desirability.

The Personal Touch in Interpreting Agreements. 658.311
Charles Weiss. *Railway Review*, May 3, 1924, v. 74, pp. 813-815. Suggestions on bridging gap between employer and employee. Blames multiplicity of rules for much of the trouble.

The Qualities of a Successful Foreman. 658.31243
R. E. May. *Railway Mechanical Engineer*, May 1924, v. 98, pp. 274-275. Discusses responsibility and leadership of the foreman and his position between management and men.

The Technique of Executive Control. 658.31242
B. E. H. Schell. 133 pp. McGraw-Hill Book Company, Inc., New York. $1.75. The author offers this book as a constructive analysis of executive conduct and a manual to executive straight thinking. He does not attempt to draw conclusions or fix standards but discusses an executive in relation to his associates and subordinates. As works of this kind usually are, it is more theoretical than practical, and therefore will be of more interest to the

young men who are seeking executive positions than to those who have reached that goal.

"Tell Truth" Retains Employees. 658.315
E. C. Kreutzburg. *Iron Trade Review*, May 22, 1924, v. 74, pp. 1357-1360. Frankness and honesty as first principles in employment relations. Results of a year of confidence.

Value of Trade Press. 658.385
A. D. Whittaker. *The Gas Industry*. May 1924, v. 24, pp. 158-162. Suggestions for getting technical journals before employees. Such reading would benefit them and their companies.

What Is the Letter of Application Worth? 658.3115
D. A. Laird. *Industrial Management* (N. Y.), June 1924, v. 67, pp. 336-342. Illus. Traditional employment methods and validity and reliability of each. Pays special attention to hand-writing as medium for character study.

Power Plants

Extracting the Gold from the Industrial Coal Pile. 658.26
S. J. H. White. *National Engineer*, May 1924, v. 28, pp. 216-218. Private power plants versus central stations and profits that may be made from proper management of power department.

Finding the Cost of Exhaust as Compared to Live Steam. 658.26
C. E. Colburn. *Power*, May 13, 1924, v. 59, pp. 759-760. How to calculate cost of exhaust steam from one or several turbines. Why an equal amount of heat can be supplied cheaper in the form of exhaust than in form of live steam.

Improving Steam Turbine Operation. 658.26
J. M. Drabelle. *Power Plant Engineering*, May 1, 1924, v. 28, pp. 478-480. Illus. Economies effected by use of electric drive for turbine auxiliaries, and recovery of heat losses of the generator by surface air-coolers.

Piping for High Pressure and Temperature. 621.101
R. A. Fiske. *Power Plant Engineering*, April 15, 1924, v. 28, pp. 424-427. Problems involved in steam power plant pipe design, resulting from high temperature and pressure. Considers fittings and joints, materials, etc.

Power Consumed in Rolling Steel. 621.944
Gordon Fox. *Iron Trade Review*, May 29, 1924, v. 74, pp. 1431-1433. Factors governing amount of power required for rolling steel. Power consumption as related to displacement of metal is presented graphically.

Power Plant Management. 621.18
(Part 5.) Robert June. *Coal Mine Management*, May 1924, pp. 59-64. Economical operation and maintenance of boiler furnaces, including methods of construction.

Power Supply of Southern Industry. 621.311
R. G. Macy. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 663-668. See Economics.

Solving an Industrial Plant Problem. 658.26
C. E. Roe. *Power*, May 20, 1924, v. 59, pp. 810-812. Illus. Private power plant proved more economical than purchased current at Arkansas factory.

Super-Power as an Aid to Progress. 621.31003
By Guy E. Tripp. 61 pp. G. P. Putnam's Sons, New York. $1.25. Contains a collection of articles and addresses prepared by the Chairman of the Board of Directors, Westinghouse Electric and Manufacturing Co., on the social, economic, and political aspects of super-power. The super-power plan is, briefly, a proposal to utilize all available water-power facilities, to supplement their output by a few large, strategically located, steam-power plants, and to interconnect all systems to form a network of power lines covering the entire country. Such a plan has been declared practicable by many eminent experts and, apparently, the only thing preventing its fulfilment is lack of the proper legislative action necessary before a project of such vast consequences can be commenced. In this volume Mr. Tripp presents a few of the reasons why super-power will increase the prosperity of the country. It will furnish an interesting and profitable half-hour's reading to anyone interested in the subject, and the subject is so broad that there should be very few people who are not interested in it.

Unit System for Pulverized Coal. 621.101
S. C. Martin. *Power Plant Engineering*, May 1, 1924, v. 28, pp. 471-472. See Fuel.

Production Control

Analysis of a Machine Shop Problem on a Quantity and Final Economy Basis. 658.5
A. L. De Leeuw. *Mechanical Engineering*, June 1924, v. 46, pp. 335-338, 362. How to determine most economical method of machining work either in large or small quantities.

Die Auswertung Arbeitswissenschaftlicher Filme. 658.5423
R. Thun. *Maschinenbau*, April 10, 1924, v. 3, pp. 454-458. Illus. Detailed description of motion study, using photographic method. Clock is described and record explained.

Berechnung von Handarbeitszeiten. 658.5421
F. Schleif. *Werkstattstechnik*, May 15, 1924, v. 18, pp. 275-277. Charts. Time study and charts applied to locksmithing.

Betriebsorganization einer Maschinenfabrik und Eisengiesserei. 658.5
Willy Bischoff. *Maschinenbau*, April 10, 1924, v. 3, pp. 445-450. Charts. Production control as applicable in machine construction and foundry practice.

Brennende Probleme der Betriebsorganization und ihre natürliche Lösung. 658
Georg Schlesinger. *Zeitschrift des Vereines Deutscher Ingenieure*, May 10, 1924, v. 68, pp. 459-462. Illus. "Management" must in its application obtain results that prove its value. Unique chart illustrates "total cost" as central point and in its relation to all other operations.

Changing Housings to Use Ball Bearings. 658.581
R. W. Drake. *Industrial Engineer*, May 1924, v. 82, pp. 216-219, 257. Illus. How bearing troubles were corrected by changing housings and frequent inspections and replacements of former bearing sleeves, end bells, and shafts.

Charts for Report Purposes. 658.532
H. N. Stronck. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 705-709. Discusses value of charts and methods of reproduction. Different types are illustrated.

Developing a Section Progress Chart. 658.53
C. Weiss. *Railway Engineer and Maintenance*, May 1924, v. 20, pp. 195-196. Charts showing cumulative performance in relation to seasonal programs, consist of straight-line diagrams of tracks with other parallel lines to show major operations on rails, ties, etc.

Distribution of Overhead to Jobs. 658.5:657
G. C. Brown. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 683-688. See Accounting.

Extreme Variety Versus Standardization. 658.5
J. H. Van Deventer. *Industrial Management* (N. Y.), June 1924, v. 67, pp. 343-347. Illus. Motor production control at Schenectady plant of General Electric Co., covering 16,000 varieties of ratings, taking into account variation in mechanical and electrical factors. System is described and illustrated.

How We Have Simplified Four Widely Different Products. 658.516
C. L. Reierson. *Factory*, May 1924, v. 32, pp. 647-650. Illus. Simplification, a means toward better quality and lower prices, as applied in a gun manufacturing shop.

Kontrolle der Arbeitszeit. 658.5421
Friedrich Schleif. *Maschinenbau*, April 10, 1924, v. 3, pp. 440-441. Illus. Time study, describes electric clock and records used to compute time for operation and wages earned.

Making and Using Time Studies: 6—Production Time-Study Installation. 658.5421
H. K. Reed. *Industrial Management* (N. Y.), June 1924, v. 67, pp. 375-382. Charts. Methods of time-study and the desirability of standardized conditions in shop where observations are made.

Methods of Sampling for Material Inspection. 658.516
H. M. Phillips. *Railway Mechanical Engineer*, May 1924, v. 98, pp. 276-278. Specifications for material often indefinite or illogical in method of taking samples for determining quality. Applies to specifications drawn up by individual engineers and those adopted by engineering societies, etc. Generalities given meant to assist specification writers.

On Every Truck-Mile We Save 7 Cents. 658.58
C. J. Smith. *System*, June 1924, v. 45, pp. 782-783, 828. Illus. Skilled mechanics and good management raised life of motor trucks from 2½ to 4 years, cut repair costs 33⅓ per cent and increased daily output of each truck.

Organizing to Prevent Material Waste. 658.516
C. B. Auel. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 669-674. Prevention of waste at Westinghouse plant by means of standardization of product.

Results of Scientific Management from the Viewpoint of Corporate Control. 658.5
M. M. Baker. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 645-646. Production control at Peoria plant of Holt Manufacturing Company and problems encountered in its installation.

Statistical Basis for Industrial Control. 658.57
Iron Age, May 15, 1924, v. 113, pp. 1441-1443. A "large numbers" method, or the study of a large number of technical conditions affecting production, applied to detection and control of defective material in iron metallurgy.

Technical Organization. 658.57
By John M. Weiss and Charles R. Downs. 197 pp. McGraw-Hill Book Company, Inc., New York. $2.50. Science is becoming increasingly important to manufacturers in the solution of their production problems, and in order to make the best use of it a trained technical organization is necessary. In this book the authors have described methods of constructing and operating a technical organization and the physical tools necessary to its proper functioning. The treatment of the subject is along broad lines in order to give the information wide application. Wherever specific examples would be helpful, however, they have been included. The final chapter deals with research and development department cost accounting and discusses the relation of these costs to profits. The book should be valuable to manufacturers who contemplate starting a new technical staff and those who already have such an organization may find some new ideas which they can use advantageously.

Wirtschaftliche Betriebsführung im Eisenbau. 658.5
J. Eberts. *Maschinenbau*, April 10, 1924, v. 3, pp. 442-444. Chart. Production control methods applied in iron manufacture, including time study and rate setting.

A Workable Production Control System. 658.5
Edward Davis. *American Machinist*, May 22, 1924, v. 60, pp. 753-757. Illus. First of a series of articles describing a control system based on periodic interdepartmental shipments of predetermined amounts of material.

Selling

Building a Successful Sales Manual. 658.807
F. Juraschek. MANAGEMENT AND ADMINISTRATION, June 1924, v. 7, pp. 674-676. Defines what a modern sales manual should be and gives suggestive chapter divisions.

Helping the Customer to Get a Better Product. 658.82
Don Gridley. *Printers' Ink*, May 8, 1924, v. 127, no. 6, pp. 100, 103, 104. How New Jersey Zinc Company gains good-will by operating a research laboratory, issuing research bulletins, and furnishing expert advice through its sales engineers.

How to Get Salesmen to Use the Sales Manual. 658.807
E. B. Weiss. *Printers' Ink*, May 8, 1924, v. 127, no. 6, pp. 41-42, 44, 48. How several manufacturers meet this problem. Series of booklets, loose-leaf book, monthly question sheets, etc.

How Your Sales Managers Can Fill in the Valley of July and August. 658.8
Ray Giles. *Printers' Ink*, May 15, 1924, v. 127, no. 7, pp. 3-4, 6, 208. Successful plans of manufacturers who stimulate their salesmen to secure a good percentage of total summer business in their line.

The Kind of Sales Manager Who Builds an Organization that Endures. 658.811
R. R. Deupree. *Sales Management*, May 1924, v. 6, pp. 977-978, 980. Keeping familiar with ever-changing conditions in his territory, setting reasonable quotas, fair treatment of salesmen, and other factors.

Marketing the Technical Product: 14. Engineering Publicity (1). 658.826
E. N. Simons. *Mechanical World* (London), March 28, 1924, v. 75, pp. 194-195, and April 25, 1914, v. 75, pp. 258-259. The manufacturer's catalog and house-organs, the most important factors in selling by printed matter, and factors to be considered in their design.

Merchandizing Controls Markets. 658.808
J. L. Mahin. *Black Diamond*, May 24, 1924, v. 72, p. 611. Overproduction is inefficient salesmanship. Discards theory of supply and demand and proves that market is the state of mind of a group of people and therefore can be controlled.

Putting the Slow-Speed Territory into High Gear. 658.808
A. A. Livermore. *Advertising and Selling*, May 21, 1924, v. 3, pp. 19, 65. Analysis of local selling problems and special advertisements to meet needs of special localities, are methods of increasing sales in slow territories.

The Straight Path to Industrial Markets. 658.8
Robert R. Updegraff. *Advertising and Selling*, May 21, 1924, v. 3, pp. 17-18, 40-43. Three logical steps toward development of a sound marketing program—analyzing product, studying present and potential markets, locating logical and prospective buyers.

What Determines the Right Sales Quota. 658.808
L. E. De Groat. *Printers' Ink*, May 8, 1924, v. 127, no. 6, pp. 19-20. Facts regarding population, estimated sales expense, volume of business for previous year, etc., as an aid to the sales executive.

What Facts Are Necessary to Set Quotas. 658.808
E. P. Cochrane. *Advertising and Selling*, May 21, 1924, v. 3, pp. 21, 58. The county unit as basis for sales territory districts.

What Should It Cost You to Sell by Mail? 658.872
Ralph K. Wadsworth. *Printers' Ink*, May 15, 1924, v. 127, no. 7, pp. 33, 34, 36. Factors entering into selling by mail, to consumer and retailer.

When Your Sales Contests Begin to Lose Their Kick. 658.811
Roland Cole. *Sales Management*, May 1924, v. 6, pp. 927-928, 1022. Three sales managers find new ideas for planning contests which will arouse and hold the salesmen's interest.

Standards and Tests

Chemical Research Works Wonders in Waste Elimination. 54(072)
D. H. Killeffer. *Manufacturers Record*, May 8, 1924, v. 85, pp. 75-77. Activities of chemists, based on laws of conservation of matter and energy, applied to prevention and control of disease, to economy in handling of heat, to checking insect pests, to various phases of industry, etc.

Darstellungs-Sonderfälle bei technischen Zeichnungen. 62(003)
Scheh. *Maschinenbau*, May 6, 1924, v. 3, pp. 531-534. Drawings. Discusses DIN specifications for machine drawing and their application to special parts.

Methods for Analyzing Raw Materials. 66(072)
R. Rimbach. *Forging - Stamping - Heat Treating*, May 1924, v. 10, p. 196a. Data sheet no. 5. Preparation and standardization of sodium thiosulphate and iodine solutions. List of reagents for analyses of raw materials.

Neue D. I. Normblatter. 62(003)
"Dinormen," German engineering standards proposed and adopted each month, appear regularly in *Maschinenbau* and *Werkstattstechnik*.

Standard Forms for Office and Shop Use. 676(003)
MANAGEMENT AND ADMINISTRATION, June

1924, v. 7, pp. 695-698. See Office Methods.

Testing of Metal Strip. 620.12
Leslie Aitchison and L. W. Johnson. *Iron and Coal Trades Review*, May 9, 1924, pp. 774-775. Drawings. Describes bend-testing machine and conditions of tests.

Transmissionen. 62(003)
(Dinbuch 6). Kurt Henschel. Normenauschuss der Deutschen Industrie. 1923. (Courtesy of American Engineering Standards Committee). 142 pp. Illustrated. A compilation, or handbook, of power transmission apparatus standards adopted by the Standards Committee of German Industry, and the application of this equipment to service. It treats of shafting, couplings, collars, keys, bearings, bearing supports, hangers, pulleys, rope drives, belting, belt tighteners, belt shifters, bushings, lubrication, anchor bolts and plates, power measurements, tolerances for fits, instructions for installation, a transmission questionnaire, calculation tables covering moments of inertia, metric and English conversions, circumferences, areas, roots, and powers; and I-beam, channel, and angle sizes and properties.

Zeichnungsnormen. 62(003)
(Dinbuch 8). A. Heilandt and A. Maier. Normenauschuss der Deutschen Industrie. 1923. (Courtesy of American Engineering Standards Committee). 72 pp. Illustrated. A compilation of drawing standards adopted by the Standards Committee of German Industry. It includes sheet sizes, arrangement of standard-form sheets, classification of drawings according to use and purpose, arrangement of views, quality of lines, cross-sectioning, lettering, dimensioning, finish marks, machining instructions, conventional indications, standard arangement of titles and notes, and bills of material.

Technical

Application of Ball Bearings to Machine Tools. 621.82
Machinery, June 1924, v. 30, pp. 776-781. Diagrs. Practical methods of applying ball-bearings to lathes, grinding machines, drilling machine spindles, and transmission shafts.

The Application of the Steam Turbine for Auxiliary Machinery. 621.125
R. W. Allen. *The Engineer*, April 25, 1924, v. 137, pp. 455, 457. Supplanting of high-speed steam engine on ships results in saving of time, space and power.

Babbitt Ball and Roller Hanger Bearings. 621.89
F. E. Gooding. *Industrial Engineer*, May 1924, v. 82, pp. 229-231, 257. Illus. Types and applications, together with methods for spreading lubricants over bearing surfaces, and ways to reduce friction losses.

Bronze Welded Cast Iron Pipe Joints Are Practicable. 621.774
H. Y. Carson. *Gas Age Record*, May 31, 1924, v. 53, pp. 757-760. Discusses methods used, non-corrosive quality of Tobin bronze, and result of tests with two varieties of cast iron pipes.

Building Lathes Interchangeably. 621.94
C. O. Herb. *Machinery*, June 1924, v. 30, pp. 758-761. Illus. Planing parts to masters, and various methods used by Chard Lathe Co. to facilitate assembly of machines and supply of replacement parts without hand-fitting.

Economical Operation and Maintenance of Boiler Furnaces. 621.18
Robert June. *The Blast Furnace and Steel Plant*, May 1924, v. 12, pp. 251-253, 260. Charts. Furnaces and boiler furnace management, discussing fuels and refractories.

Electrical Metering Instruments in the Pulp and Paper Making Industry. 621.3175
O. C. Cordes. *Paper Trade Journal*, April 24, 1924, v. 78, pp. 48-51. Illus. Discusses meters showing at all times power required by various machines.

Electrically-Operated Pumps in Industrial Plants. 621.64
The Engineer, April 25, 1924, v. 137, p. 458. Charts. Analysis of elements affecting overall efficiency of pumping units.

The Engineering Index 1923. 62(016)
700 pp. The American Society of Mechanical Engineers. New York. $7.00. Contains brief reviews of important articles which appeared during 1923, in nearly 700 American and foreign periodicals which are received by the Engineering Societies Library. The items are arranged alphabetically according to subjects discussed, with numerous cross-references which increase the value of the volume. It provides an excellent reference book inasmuch as there are few subjects of a technical nature that have not been discussed in some periodical during the past year. By referring to the proper subject heading a short review is found, of all articles published on the subject with information concerning the publication in which the article appeared so that steps may be taken to secure a copy of it if so desired.

Experiences with Multiple Feed High Pressure Lubrication. 621.89
L. R. Humpton. *The Blast Furnace and Steel Plant*, May 1924, v. 12, pp. 236-237. Illus. Manifold safety lubricator increases efficiency and decreases cost.

Extension Study Course in Coal Mining: Part 4, Haulage. 622.6
Adam Crawford. *Coal Mine Management*, May 1924, pp. 44-54. Illus. Electric mine locomotives: historic survey of use, types, construction features, motors and comparative capacity.

Falkirk Uses New Methods. 621.72
H. C. Esteys. *The Foundry*, May 5, 1924, v. 52, pp. 331-339, 363. Illus. How introduction of sand-throwing molding machine has increased output of bath-tubs, and miscellaneous castings in the old Scotch iron foundry community of Falkirk.

Geistige Schöpfung als Grundlegende Forderung der Patentfähigkeit. 608
H. Neumann. *Maschinenbau*, April 10, 1924, v. 3, pp. 461-464. Value of real inventive genius in industry. Problem of Patent Office to decide between patentable inventions and mere construction improvements, and advisability of having technically trained men in this office.

Heavy Oil Engine Indicator Diagrams. 621.43
J. M. Ferguson. *The Petroleum World* (England), May 1924, v. 21, pp. 200, 202-204. Diagrams. Abstract of paper read before the Diesel Engine Users Association. Discusses comparisons of diagrams, hints on taking diagrams, indicators, and value of diagrams.

High Pressure Turbines. 621.165
The Engineer, May 2, 1924, v. 137, pp. 489-90. Diagrams. Technical details of the Brown, Boveri turbine, developed to improve power plant efficiency.

Looking into the Mirror of Introspection. 621.73
G. H. Koskey. *Forging-Stamping-Heat Treating*, May 1924, v. 10, pp. 176-179. Drop forging problems within the trade and plant.

Manufacturing to Close Limits. 621.9
B. H. Blood. *Abrasive Industry*, May 1924, v. 5, pp. 126-129. Practical application of tolerances in manufacture.

Providing Safety in Electric Welding. 621.392
D. H. Deyoe. *Iron Trade Review*, May 8, 1924, v. 74, p. 1235. Safety measures for arc welders.

Recovery of Waste Heat in Open Hearth Practice. 669.8
W. Dyrssen. *Iron and Coal Trades Review*. May 9, 1924, pp. 759-766; May 16, 1924, pp. 836-837. Charts. Diagrams. A thorough analysis of furnace operation and methods for conserving heat. Followed by discussion.

Short-Center Belt Drives. 621.85
G. A. Frenkel. *Machinery*, June 1924, v. 30, pp. 747-753. Diagrs. Reduction of stresses in belt and of pressure on the bearings and other advantages of short-center belt drives. Layout and arrangements of different drives, etc.

Steady Progress in Steam Power Economy. 621.1(09)
J. T. Beard, 2nd. *Industrial Management* (N. Y.), June 1924, v. 67, pp. 329-335. Illus. Historic survey of steam engineering from Newcomen engine to mercury boiler.

Taking the Guesswork Out of Dies. 621.961
C. C. Rhead. *Forging-Stamping-Heat Treating*, May 1924, v. 10, pp. 188-193. Recording the performance of dies used in production of pressed metal parts.

Universal Treatment of Timber Will Save Money. 691.15
H. S. Sackett. *Railway Age*, April 26, 1924, v. 76, pp. 1049-1050. Large econ-

omics would result from using treated wood for cars, railroad bridges, ties, etc.

Über die Mathematischen Grundlagen der Nomographie. 510.8
L. Bieberback. *Zeitschrift des Vereines Deutscher Ingenieure,* May 17, 1924, v. 68, pp. 495-498. Charts. Discusses and illustrates mathematical principles of nomography.

Utilization of Decayed Wood in the Chemical Processes. 676
J. D. Rue, R. N. Miller, and C. J. Humphrey. *Paper Trade Journal,* May 15, 1924, v. 78, pp. 44-48. Illus. Use of decayed wood in sulphite and soda processes.

Where Wiring Can Be Improved Around Machines. 621.3
Industrial Engineer, May 1924, v. 82, pp. 220-224, 259. Illus. All manner of wiring improvements and safety measures with illustrations of good and bad installation.

Training

Business Training for Engineers. 62(07)
P. M. Atkins. *The Armour Engineer,* May 1924, v. 15, pp. 131-133. Discusses what training in business a prospective engineer should have.

Making the Skilled Mechanic of Tomorrow. 658.3861
F. A. Pope. *Industrial Management* (N.Y.), June 1924, v. 67, pp. 363-367. Illus. Plan for apprentice training in metal trades adopted by a branch of National Metal Trades Association.

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Training Men Quickly for Special Needs. 658.386
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R. Bolt. *Maschinenbau,* April 10, 1924, v. 3, pp. 450-454. Charts. Study of comparative results obtained from ability tests applied to a group of 33 apprentices admitted to the Siemens-Schuckert works at Nurnberg. Ratings given during two years of their apprenticeship, based on character analysis and proved ability. Charts illustrate records kept.

Transportation

An Analysis of Costs for 10 Years of Fleet Operation. 656.124
R. E. Plimpton. *Society of Automotive Engineers Journal,* May 1924, v. 14, pp. 539-544. Charts. Operating costs of motor vehicles from viewpoint of maintenance or replacement, considering (*a*) physical depreciation, (*b*) obsolescence and (*c*) inadequacy.

Daily Program and Performance of a Locomotive. 621.13
R. S. Parsons. *Railway Review,* May 17, 1924, v. 74, pp. 884-886. Discussion from transportation viewpoint of locomotive performance in fast freight, slow freight, and switching service.

An Evolution in Transportation. 629.113
J. W. Drake. *Michigan Manufacturer and Financial Record,* May 31, 1924, v. 33, pp. 2, 27. Motor vehicles in private and industrial life, and their relation to railways, highways, etc.

Highway Transport—The Newcomer. 656.124
R. D. Chapin. *Michigan Manufacturer and Financial Record,* May 31, 1924, v. 33, pp. 6, 25. Survey of the motor vehicle as a means of transportation. Discusses freight service, bus lines, rural trucking, etc.

Improved Methods Produce Results in Kansas City. 658.9:656.4
Electric Railway Journal, May 24, 1924, v. 63, pp. 807-811. Management methods applied to Kansas City Railways, under receivership, resulted in improvement of service and increased income.

Observations of a Superintendent of Motor-Truck Fleet-Operation. 656.124
J. F. Winchester. *Society of Automotive Engineers Journal,* May 1924, v. 14, pp. 496-503. Illus. Selling, operating, and maintenance of motor trucks, including discussion of operating costs, records and record forms with specific recommendations.

Railway Rates and Cost of Service. 656.23
By Owen Ely. 145 pp. Houghton Mifflin Company, New York. $2. Contains a technical discussion of the relation between railway freight rates and the cost of service, and of the economic and social disadvantage of the present rate structure. The author describes the various rate-making theories such as "value of service," "joint cost," and "monopoly," and states that they are unsatisfactory foundations for a general rate structure. He believes that a scientific study of the entire rate problem should be made, a better method of fixing rates determined, and the present rate structure revised. There are 5 outstanding economic and social problems the solution of which, the author believes, will be materially aided by scientific revision of the rate system: (1) The proper distribution of population between city and country; (2) the stimulation of foreign trade; (3) the maintenance of an efficient transportation system; (4) the synchronization of rate and weight regulation with changes in commodity prices; (5) an equitable adjustment of the rights of railroad employees, investors in railroad securities, and the shipping and traveling public.

The Relation of the Vehicle Builder to Motor Transport. 656.124
David Beecroft. *Society of Automotive Engineers Journal,* May 1924, v. 14, pp. 522-526, 538. Motor trucks, motor cars, and motor buses used wholly for business purposes are considered, and plea made for more clearly defined relations between producer and consumer. Discusses operation problems, privately owned service stations, possible economies, etc.

Train Delays and Loss and Damage Claims. 656.22
G. D. Brooke. *Railway Review,* May 31, 1924, v. 74, p. 971. How claim payments for delays are related to car supply, per diem costs and car miles per day.

Wages

Comparison of Premium Wage Plans. 658.3225
R. F. Miller. Management and Administration, June 1924, v. 7, pp. 699-704. Tables. Job costs, amounts of wages and relative advantages under different systems.

Group Insurance of Employees. 658.3253
E. S. Hanson. *Cement, Mill and Quarry,* May 20, 1924, v. 24, pp. 39-40. Arguments in favor of group insurance.

Maintains Standard Time System. 658.3231
Iron Trade Review, May 22, 1924, v. 74, pp. 1370-1372. Employee representation and method for establishing wages on equitable basis adopted by Westinghouse Electric and Manufacturing Co. Standard time system proved satisfactory.

Wages and Hours in Manufacturing. 658.32
Iron Age, May 8, 1924, v. 113, pp. 1356-1357. Analysis of iron and steel, and foundry and machine shop groups from July 1914 to January 1924.

Wages, Hours, and Employment in American Manufacturing Industries. 331.2
Research Report No. 69, National Industrial Conference Board. New York. 104 pp. $2.00. This report, the eighth general survey of trends in wage-earnings in American manufacturing industries, lays special emphasis on the movement of hourly and weekly earnings during the last half of 1923, in relation to the peak of industrial activity in 1920 and to the pre-war period. Such a study of the wage movement during this period, in connection with the general movements in employment, working hours, and hours of plant operation affords a valuable basis for judgment regarding future trends in these important industrial factors. The investigation, upon which the report is based, covered 1,678 manufacturing plants, employing, in June 1920, 697,965 workers. The data on wage-earners has been divided by sex and then into occupational classifications of male skilled and unskilled laborers. Twenty-three industries have been studied, covering a wide field of manufacturing activity.

Why I Don't Believe in the Straight Commission System. 658.3236
William L. Fletcher. *Sales Management,* May 1924, v. 6, p. 974. Maintains that losses due to turnover of salesmen are much larger when on commission basis, than when on salary basis.

CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

Decline Continues: Improvement Is Indicated by Recent Developments

PREPARED BY LEWIS H. HANEY

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During June the main forecasting line, the P/V line, turned upward a little more decidedly. From the low point of the year of 88.7 reached in April this index of the future advanced to 90.4 in May and to 91.5 in June. This upturn is due to the relatively small decline in Bradstreet's price index, combined with the continued rapid decrease in the physical volume of industry and trade. The rise in the forecasting line indicates that an equilibrium between demand and supply in the commodity market has been reached and that demand is becoming relatively stronger. Firmer prices are in prospect and better profits should follow.

It is to be remembered that this is in the future and may be expected somewhere between 4 and 6 months after the P/V line turns up. At present the general business recession is still under way. Conditions in most industries are not good, and in some lines the bottom had not been reached at the middle of July. This is notably true of iron and steel.

Present indications do not suggest any great or rapid recovery. For example, consumer purchasing power is not likely to increase in the near future. This conclusion is borne out by the relatively small rise in the P/V line. It is entirely possible, however, that considerable inflation in credit may develop soon, and if this is the case a large inflationary upturn might get under way.

The upswing in business which has been forecast still seems probable about October.

June data make it seem very unlikely that there will be any early reversal in the trend of the main forecasting line. It is clearly on the upgrade and the continued downward adjustment in production lends strength to the future situation in business.

Recent Developments

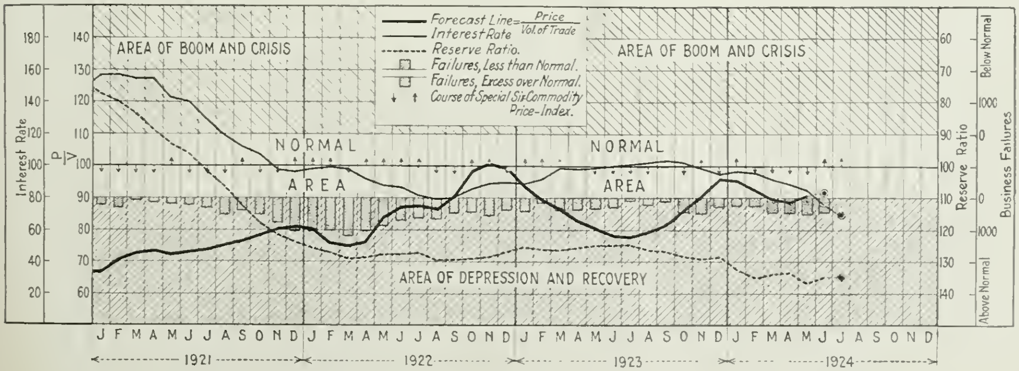
Probably the outstanding developments during June and the early part of July are those in the following list. In general, however, it may be said that numerous indications suggest that the bottom of the present recession is near and that evidence of this fact is the leading current development.

1. Increased evidence of more stable price levels: Bradstreet's slightly down, Dun's up, six-commodity index unchanged. (Fig. 9).
2. Business failures decreased. (Fig. 10).
3. Further easy money rates result in heavy buying of bonds and stocks.
4. Upturn in the adjusted index of bank debits. (Fig. 7).
5. A more favorable outlook for retail trade, especially mail orders, following the May slump. (Fig. 8).
6. Increased talk of inflation, with conditions favoring it stronger.

Favorable Factors

The favorable factors, though much the same as last month, have gained somewhat in weight.

1. Continued rapid checking of production. (Fig. 2).
2. More stable price levels, with conflicts in various indexes which seem to indicate a turn. (Fig. 9).
3. Higher grain and live stock prices.
4. P/V line moves up again. (Fig. 1).
5. Money at bottom levels. (Fig. 9).
6. Decreased business failures. (Fig. 10).



Data on the compilation of this curve can be obtained upon request to the editors. July data are estimates.

Fig. 1 The Barometer of Industry and Trade

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[1] Assisted by Horace J. Barney and R. H. Leding of the Bureau's Staff.

7. Mail order sales and bank debits turn up. (Figs. 7 and 8).

Unfavorable Factors

1. Building activity declines sharply. (Fig. 6).
2. Employment and earnings of labor continue to decrease; considerable unemployment in some sections. (Figs. 11 and 12).
3. Poor crops in prospect, especially corn.
4. Unfilled steel orders down. (Fig. 3).
5. Stocks of basic commodities in first hands large. (Table 1).

Future Dangers

The factors which may be listed as dangers affecting the industrial future are much the same as those mentioned in the last issue of MANAGEMENT AND ADMINISTRATION and are not here repeated. It should be emphasized, however, that two of the outstanding points appear to be the downward trend of purchasing power among consumers, and third party developments in politics. The former will be discussed below.

As to the political situation it is not to be denied that with two rather conservative candidates representing the Republican and Democratic parties, there is a possibility that the La Follette movement may gain sufficient strength to insure a pretty strong representation of radical elements in the next Congress. Mr. La Follette may hold the balance of power. Radical legislation is not improbable, and it will be an important factor. It is even within the bounds of possibility that the choice of president may be thrown into the House of Representatives where each state would cast one vote with 25 votes required for election.

While wheat, corn, and hogs promise to be relatively high in price this fall, it must be remembered that the production of these commodities will be smaller and that the farmers are not yet in a favorable economic condition.

Main Barometer Analyzed

Turning to the main barometer (Fig. 1) the general situation there shown deserves careful attention. The P/V line has already been discussed, but attention is called to the fact that it is still below normal. It is highly significant that the interest rate is now under the lowest point reached in the summer of 1922, and the curve showing the trend of that rate lies in the area of depression and recovery. This index gives strong indication that business recession is not likely to go much further and that the basis for improved conditions is strong.

The failure bars still project into the area of depression, but are decreasing in length, which indicates that business is tending towards the normal area. The cyclical six-commodity price index appears to be tending upward as has usually been the case in the past when the P/V line has risen. The reserve ratio curve, which has been in the area of depression for nearly three years on account of the abnormal gold reserves held in this country, shows a sharp upturn in June after allowing for seasonal variation, and recovered most of the decline made in May. Although present abnormal conditions with reference to gold deprive the reserve ratio of much of its significance, it is possible that this sharp upturn may indicate the beginning of a revival in business.

Three Unfavorable Conditions

When all has been said, however, there remain at least three very unfavorable conditions which are of sufficient importance to prevent a very early or a very great business revival—barring inflation. In the first place, there is the continued decline in employment and earnings. In Illinois, employment in June dropped 3.4 per cent and more unemployment existed than at any time in the last four years. In Pennsylvania, employment dropped 4.8 per cent and in New Jersey, 2.8 per cent. In New York, after allowing for seasonal variation, employment decreased 1.6 per cent and was only 5 per cent greater than the average for 1921. As to earnings, the pay-rolls of identical establishments in Illinois showed a decrease during June of 4.8 per cent. Pennsylvania and New Jersey average weekly earnings of labor decreased 5.1 per cent and 0.4 of 1 per cent, respectively. In New York, earnings, after allowing for seasonal variation, were over 2.4 per cent lower.

These decreases are greater than have taken place in the cost of living. In fact, the Department of Labor reports an increase in retail food costs as of June 15. This diminished purchasing power of laborers, while it will be favorably affected when business and industry begin to revive, has now gone so far that it must be considered a serious drag on the initiation of the upturn and will serve to impede progress.

The Stock Situation

In the second place, stocks of the commodities in first hands are large. In fact, the Department of Commerce reports an increase in such stocks at the end of May and the majority of the commodities covered in Table 1 do not show a strong situation in this respect. Here is another drag on business recovery. In spite of reduced production, the stocks held by manufacturers are still so large in many industries as to reduce the chances for firmer prices in the near future.

In the third place, there has been a further weakening in those industries which were the main supports of the business up-swing in 1923. Building activity (Fig. 6) is decidedly on the down-grade with contemplated construction at lower levels than obtained last year. In fact, deferred building appears to be very small in amount and this, together with the rapid decline in contracts awarded, suggests a low level of activity during the fall and winter months. Railway traffic (Fig. 2) and earnings have been declining and the surplus of cars and locomotives in good condition suggests a smaller demand for iron and steel from this source. Automobile production has moved down for some months, and, while sales have lately shown some strength, the demand from this industry does not compare favorably with last year. These things are special drawbacks to recovery in the iron and steel trades.

Effects of Possible Inflation

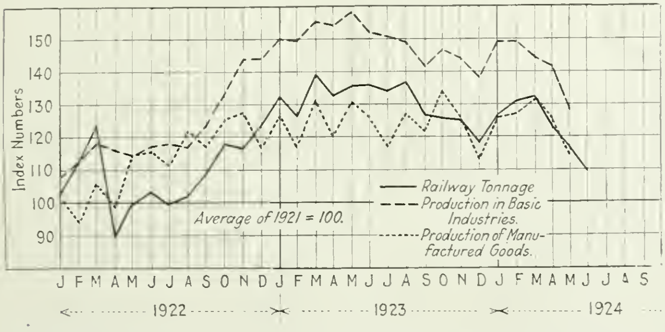
Concerning the increased talk of inflation, it must be noted that conditions favorable thereto continue with increasing strength. Gold imports continue large. Money is at very low levels. The reserve ratio, naturally, is at a very high point. At the same time the loans and discounts of member banks have increased and are relatively large. The effects of easy money are now apparent in the increased loans made by banks on securities and by the investments of those institutions in bonds and stocks. The policy pursued by member banks of abstaining from rediscounts at the Reserve Bank appears to have gone about as far as possible, which makes it more likely that from now on the large gold imports will have their effect on credit and prices. While it does not seem that there is yet any sound basis for predicting an inflationary boom, it must be admitted that it is a possibility and might easily get under way if those who direct the nation's financial policy were to offer it any encouragement.

This condition deserves careful watching by business men, for if, as, and when the inflation element becomes strong in money and credit, a boom will start with rising prices. This would call for: (1) prompt action to secure the profits resulting from the upward trend; and (2) great caution to prevent being caught at the peak.

Production and Stocks of Commodities

Production Still in Excess of Demand

Stocks in first hands continue large. The latest complete data are for May when there was a considerable increase. The following facts are shown in Table 1. Gasoline stocks are abnormally large and cuts in gasoline prices have been prevalent. Merchant pig iron stocks increased considerably and are abnormally large. Zinc stocks showed a large increase in June and July. Stocks of newsprint paper have increased for the fifth consecutive month. On the other hand, the following commodities are in smaller supply: rubber tires, raw sugar at refineries, and cottonseed oil. The decrease in automobile tire stocks, although small, is significant.



Sources, Federal Reserve Board: N. Y. U. Bureau of Business Research. Railway tonnage and production in basic industries corrected for seasonal variation, and the latter also for normal growth.

FIG. 2 RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

Production and Railway Tonnage

Railway Tonnage. The estimated tonnage hauled by Class 1 railways fell from 103.3 million tons in May to 99.6 million tons in June, a decline of 3.6 per cent. The adjusted index, which allows for seasonal variation, in June stood at 109.3 against 116.8 in May, a drop of 6.4 per cent. (See Fig. 2).

Production. In May the production in basic industries as reported by the Federal Reserve Board declined 9.6 per cent, after eliminating seasonal variation. The index (based on 1921 as 100) was 128.1 against 141.8 in April. Manufacturing production also went down sharply, falling from an unadjusted index of 125.4 to 114.9.

Conclusion. The rapid readjustment in output has continued and physical volume of production seems now well below the normal level. Accordingly the effects of this curtailment should soon become apparent. While further downward adjustment will undoubtedly occur owing to the momentum of the movement now under way, markets show signs of approaching stability with firmer prices for most commodities. Present indications suggest that the current process of readjustment in industry will be completed by October.

Iron and Steel Production

Production. Pig iron production fell off 20 per cent during June, the average daily rate being cut to 67,541 gross tons, and the seasonally adjusted index (see Fig. 3) now standing at 150.

Steel ingot production declined 15.5 per cent during June to a daily rate of 82,259 tons per day, the lowest since January 1922. Steel mills are now running at less than 45 per cent of capacity.

Unfilled Orders. Unfilled orders of the U. S. Steel Corporation fell 10 per cent further during June, the adjusted index now standing at 62.7.

Prices. The Iron Age composite price for finished steel on July 15 was 2.589 cents per lb. which is 0.5 per cent lower than the price (2.603) the month before. The composite price for pig iron was $19.29 per gross ton, 4.2 per cent lower than last month's price of $20.13, and the lowest in over two years.

Conclusion. Although it seems hardly probable that production can continue at its present low levels or prices go much lower, conditions in the industries which are the chief sources of demand give no indications of early improvement. With contemplated building construction and automobile production on the decline, and railways continuing to show little indication of early increased demands for rails and equipment, no stimulating factor is yet in sight. Some strength shown in the Chicago price of scrap iron may be of significance, however, in considering the present status of pig iron prices.

Production in Important Industries

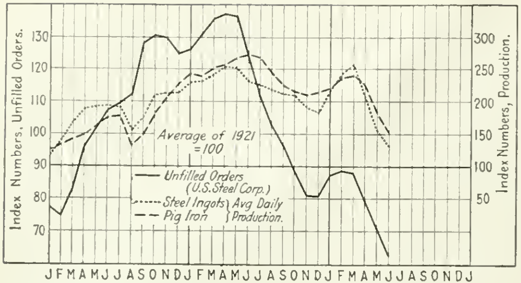
Copper. Copper production continues at about the same level. (See Fig. 4). There is little demand, however, and although prices have probably reached bottom, the industry awaits the development of favorable factors.

Paper. Paper production in May was still slightly higher than in April. Prices seem to have stabilized and conditions point toward improvement.

Wool. Wool consumption continued its sharp decline during May. The index, corrected for seasonal variation, now stands at 76.0, the lowest point since February 1921. A stagnant market at

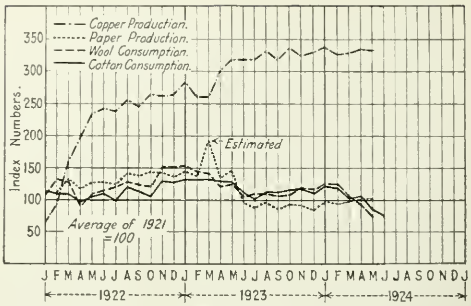
TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH
Average for 1921 = 100. Gasoline, raw sugar, cottonseed oil and Dept. of Commerce index adjusted for seasonal variation

MONTH AND YEAR	GASOLINE	LEATHER (Cattle)	ZINC	NEWSPRINT PAPER	AUTOMOBILE TIRES	RAW SUGAR	COTTONSEED OIL	MERCHANT PIG IRON	DEPT. OF COM. INDEX OF STOCKS—45 COMMODITIES
	100 = 630,757,000 gals.	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,009 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.	100 = 634,950 tons	100 = 132
Jan. 1923	156	85.3	23.6	64.0	105.4	55.0	52.0	35.8	87.7
Feb.	156	84.0	21.5	76.7	107.6	76.0	60.0	43.0	84.1
Mar.	154	82.6	14.1	77.3	119.7	86.0	64.5	44.0	84.8
Apr.	162	81.6	13.0	67.2	129.9	168.0	67.0	38.0	84.8
May	164	81.4	11.6	62.9	139.3	147.0	69.0	41.7	80.4
June	173	82.1	16.9	60.5	159.6	97.0	71.0	53.6	83.3
July	174	82.8	22.2	65.0	161.4	97.0	76.0	72.7	82.6
Aug.	185	83.6	27.5	74.0	148.0	96.2	74.0	97.5	90.6
Sept.	199	84.3	34.4	85.5	138.5	81.8	57.4	111.0	95.5
Oct.	206	84.2	29.6	82.2	123.2	130.4	28.0	121.7	85.5
Nov.	211	85.4	33.4	82.4	111.7	102.8	43.0	131.0	88.4
Dec.	202	85.8	40.3	80.0	107.5	89.8	43.3	141.0	90.6
Jan. 1924	186	87.0	47.3	78.8	99.0	79.0	52.5	145.0	98.6
Feb.	187.5	79.5	52.7	94.6	110.0	54.5	53.5	144.5	97.8
Mar.	188	83.8	48.0	101.0	120.5	90.0	58.5	140.0	98.6
Apr.	203	81.2	41.5	103.0	132.0	143.0	60.2	139.5	98.6
May	197	81.4	42.5	105.6	141.3	125.6	63.2	148.6	102.9
June	214	82.2	54.9	114.9	140.1	99.4	62.4	....	....
July	....	....	64.3	....	....	....	....	....	....



Sources, Iron Age; American Iron and Steel Institute. All curves corrected for seasonal variation.

FIG. 3 IRON AND STEEL PRODUCTION AND UNFILLED ORDERS



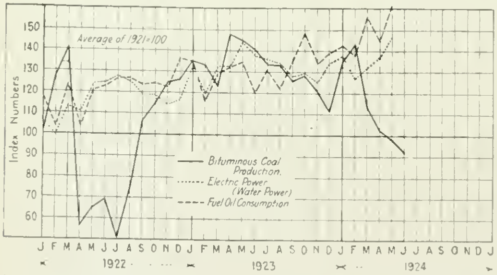
Sources, American Bureau of Metal Statistics; American Paper and Pulp Association; Bureau of Census; Department of Commerce. Cotton and wool curves corrected for seasonal variation.

FIG. 4 PRODUCTION IN FOUR IMPORTANT INDUSTRIES

low levels makes an early improvement in production seem unlikely.

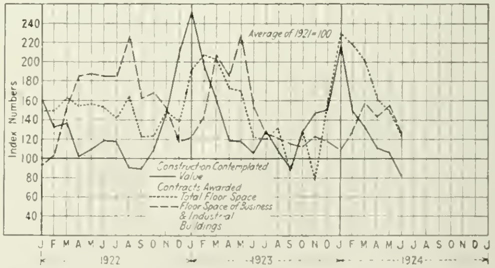
Cotton. Cotton consumption fell off still further during June, and the seasonally adjusted index now stands at 76.3 per cent of the average for 1921. Curtailment can not go much further, and some scarcity in cotton goods is already felt. The trade, however, is waiting for further developments in the raw cotton market and buyers are still holding off.

Conclusion. A stagnant market is the outstanding factor in the condition of the foregoing industries. Although further decreases in production and prices are extremely unlikely, the upward turn has not yet begun, and is not likely to come for another month or two, or until the early fall.



Sources, Department of Interior; Bureau of Mines; United States Geological Survey. Bituminous coal and electric power curves corrected for seasonal variation.

FIG. 5 FUEL AND POWER PRODUCTION



Source, F. W. Dodge Company. Construction contemplated curve corrected for seasonal variation.

FIG. 6 BUILDING CONSTRUCTION AND FLOOR SPACE

Fuel and Power

A widely divergent trend is shown by the curves in Fig. 5.

Coal. The production of bituminous coal showed a continued downward trend during June and early July. The index, which eliminates the usual seasonal variation, has now moved downward for four months and in June registered 92 against 98.5 in May. This is the lowest level reached since February 1923.

Fuel Oil. The consumption of fuel oil continued upward during June. The indicated domestic use in that month was over one million gallons and the index was 162 against 145 in May (the average for 1921 being 100). Thus there has been a fairly steady increase since June 1923. At present the market for fuel and gas oils is dull, with New York bunker oil quoted at $1.75 at the refineries.

Hydroelectric Power. The output of hydroelectric power increased again in June even after allowance for seasonal variation. This may be due to wet weather affecting water-power.

Conclusion. There has apparently been a tendency to substitute oil and electricity for coal. Coal production, however, appears to be near the bottom, and it is doubtful if the decline lasts another month. Firmer prices are in prospect, especially when the bulk of the winter supply begins to move.

Building Activity in June

As shown in Fig. 6, building activity decreased during June.

Contemplated Construction. There was another sharp drop of over 24 per cent in the F. W. Dodge Company's figures of value of contemplated construction. Contemplated construction is now below the value of contracts awarded in several sections and is the lowest since September 1923. In fact, the figures are the lowest for the month of June since 1921. The adjusted index number, eliminating seasonal variation, was 80.4. (The monthly average for 1921 is taken as 100).

Contracts Awarded. The total floor space in building actually started during June declined about 16 per cent. The adjusted index fell from 149 to 122.5, which is the fifth consecutive decrease.

The floor space in business and industrial buildings also decreased. The index, which is not adjusted, fell to 123 from 155. This is the lowest June figure since 1921. Industrial building is at a specially low ebb in practically every part of the country, reflecting both the business decline and the reaction against high costs of construction.

Conclusion. Present indications suggest that the low levels of last winter will be reached this fall and the chances favor a decline below those levels. This is due to the small reserve of deferred building projects and relief of the housing shortage. The next upturn in building activity, which may be expected next year, is likely to be in industrial and commercial construction.

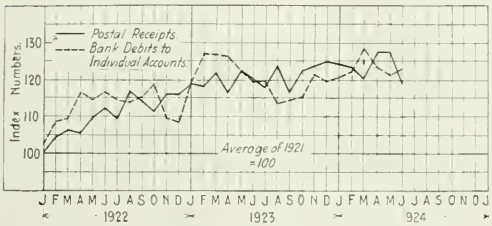
Trend of Trade and Finance

Price Drop and Trade Activity Nearing the Bottom

Bank Debits and Postal Receipts

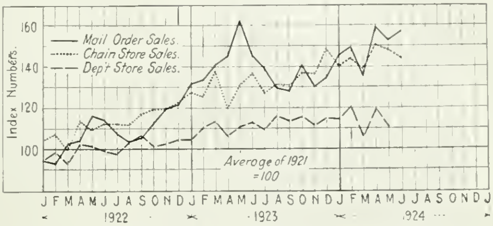
Bank Debits. The volume of checks drawn during June increased more than usual for June. It is still below March and April. The adjusted index in Fig. 7 now stands at 123.1 compared with the 121.7 in May.

Postal Receipts. The June figures show a rather sharp loss in the receipts at 50 selected post offices (for 25 working days). The adjusted index, which eliminates seasonal variation, fell from 127 in May to 119.2 in June.



Sources, Federal Reserve Board; Post Office Department. Both curves Corrected for seasonal variation.

FIG. 7 BANK DEBITS AND POSTAL RECEIPTS



Sources, Commercial and Financial Chronicle; Federal Reserve Board. Data cover 2 mail order houses, 4 chain stores, and 306 department stores. All corrected for seasonal variation.

FIG. 8 SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES

Conclusion. Both the foregoing important indexes show that the volume of business is still slightly larger than it was a year ago. The future trend as judged by these indexes, however, is somewhat uncertain and present indications suggested further declines.

Retail Trade

Mail Order Sales. After eliminating seasonal variation, mail order sales made a good increase in June. The adjusted index moved up from 152 in May to 157, a gain of 3.2 per cent. (See Fig. 8).

Chain Store Sales. The sales of the four leading chain stores showed decreases both absolutely and after eliminating seasonal variation. The adjusted index fell from 148.3 to 143.9, a loss of 3 per cent in June.

Department Store Sales. The latest available data are for May. In that month the adjusted index fell from 119.7 (April) to 110.5.

Conclusion. The indicated trend of retail trade, especially mail orders, is still good, although purchasing power of labor and farmers is declining. Small retail stocks form the basis for rapid recovery.

Prices and Interest Rate

Prices. Bradstreet's index, Fig. 9, which is the price index having most barometric value, decreased 0.5 of 1 per cent during June. The index on July 1, was 108.6, against 109.1 on June 1. Wholesale prices are now approximately 9 per cent below the lowest level in 1923, and are 12 per cent below the high point reached in March 1924. The rate of decrease, however, has clearly been checked.

The Bureau's special six-commodity index showed a slight gain in June, rising from 105.2 in May to 105.5 in June. The advances and declines were equally divided.

Interest Rate. The Bureau's index of the rate on best commercial paper during June was 58.1. The average rate in June was 3.8 per cent and at the middle of July was 3.5 per cent.

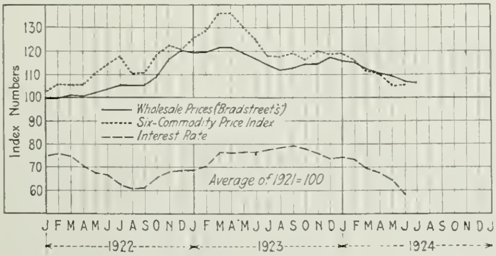
Conclusion. Further irregularity will exist, but indications are that the general price level will soon begin to advance. As money rates lag considerably behind price changes, it is practically certain that very easy money will persist well into the fall months.

New Enterprises and Failures

Business Failures. The index for the single month of June showed a slight decrease and stood at 111.4, but the three-months moving average in Fig. 10 is still up. The effect of high indexes for the individual months of April and May outweigh the June decrease.

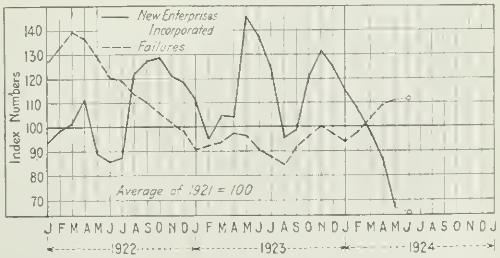
New Enterprises. The index of new enterprises continues its long decrease, and for June was 67. The curve has declined sharply for six months.

Conclusion. Business failures and new enterprises show accurately the depressed conditions existing. Business failures are 11 per cent more numerous and the volume of new enterprises is 33 per cent less than in 1921. These curves, however, are not of such great value as *forecasting* lines, serving rather to portray present and past conditions.



Sources, Commercial and Financial Chronicle; Federal Reserve Board. Interest rate is the monthly average, corrected for seasonal variation.

FIG. 9 WHOLESALE PRICES AND INTEREST RATE



Sources, Dun's Review; New York Journal of Commerce. Both curves plotted as a 3 months' moving average, centered and corrected for seasonal variation.

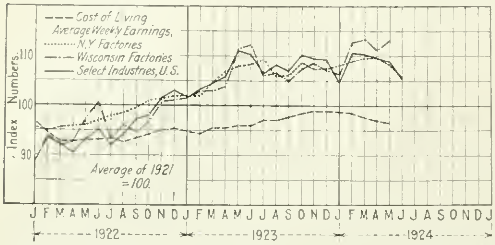
FIG. 10 NEW ENTERPRISES AND BUSINESS FAILURES

Wage and Employment Situation

Earnings and Employment Still Decreasing

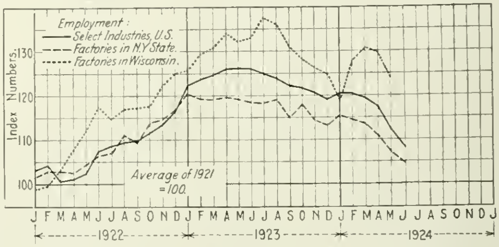
Earnings and Cost of Living

Selected Industries in the United States. The index of per capita earnings decreased from 108.7 to 105.3 in June, due partly to a drop of 2 per cent in full time operation, but chiefly to reduction in wage rates. Wage rate decreases were reported by 102 establishments, one-half of them being in the lumber group, and one-quarter in the textile industries. Slight wage rate increases were reported by 23 establishments. (See Fig. 11).



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin; National Industrial Conference Board. New York and Wisconsin curves corrected for seasonal variation.

FIG. 11 WAGES AND COST OF LIVING



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin. All curves corrected for seasonal variation.

FIG. 12 THE TREND OF EMPLOYMENT

New York State. Actual average weekly earnings in New York factories were $27.21 in June. This is a decline from $27.54 the previous month. The index, after adjustment for seasonal changes, now stands at 105.7.

Wisconsin. The seasonally adjusted index of earning in Wisconsin increased 2 points in May to 113.2. The increase is probably due to the release of lower paid labor which is more sensitive to employment conditions than is skilled labor. It does not indicate higher rates.

Cost of Living. In May the index of living in the United States decreased slightly. It stood at 96.7; lower than in any month since June last year.

Conclusion. Per capita earnings continue to decline. In both the United States as a whole and in New York they are less than 6 per cent above the average for 1921. While this means lower purchasing power, the situation is not so bad as it might seem. Last year in June the indexes were 110.4 and 108.2 respectively. The low point for United States earnings was January 1922 (88.7); and for New York, November 1921 (94.6).

The Employment Trend

United States. The seasonally corrected index (See Fig. 12) decreased from 112.3 to 108 in June. It has been declining continuously since February, and is now at approximately the same point as in June 1922. It is 15.5 per cent higher than in January 1921.

New York State. The index, after correction for seasonal variation, declined to 104.5 in June. It has been decreasing continually since January of this year, when it stood at 115.4. Employment in New York State is now at the lowest point since May 1922. (The lowest index in 10 years is 96.8 for July 1921).

Wisconsin. After adjustment for seasonal variation, the May index showed a decrease from 129.7 to 124. All industries except the food group showed fewer employees. The greatest reductions were in the metal working and wood working industries.

Conclusion. For the second month all reports show decreases in employment. The number employed in New York State is only 4.5 per cent above the average for 1921, and in the United States 8 per cent above that average. (The Wisconsin index, while a month late, is clearly out of line with the others, being 24 per cent above the average for 1921.) Decreased employment, coupled with decreased per capita earnings generally is bound to have an effect on labor's buying power. At the same time it shows that production and manufacturing costs are being adjusted, and means a tendency to greater efficiency on the part of labor.

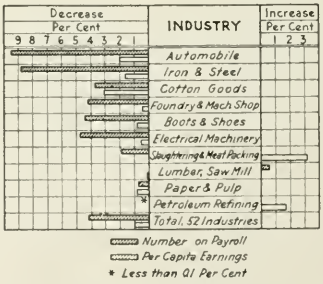


FIG. 13 TREND OF EMPLOYMENT AND EARNINGS, MAY 1924

Employment and Earnings in Selected Industries

The trend of employment and earnings of 10 leading industries in May is shown in Fig. 13.

Employment. There was a notable decline in the number of persons employed. Only one of the industries analyzed, saw mills, showed increased employment. This increase was only 0.6 per cent. The decrease in the automobile industry was 9.5 per cent and in iron and steel 8.8 per cent. Smaller, but important decreases occurred in electrical machinery, foundry and machine shops, boots and shoes, cotton goods, slaughtering and meat packing. The average decrease for 52 industries was 4.2 per cent.

Per Capita Earnings. As in the previous month, the trend was downward, but not so pronounced as in employment. The cotton goods industry led the decreases with a drop of 3.1 per cent. Only two showed increases, slaughtering and meat packing, 3.2 per cent, and petroleum refining, 1.7 per cent. For 52 industries reporting the average decrease was 1.0 per cent.

Immigration and Emigration

During May immigration decreased and emigration increased. Consequently the net gain was less than in April, being about the same as in February. In comparison with May 1923, the net gain is but little over half as great.

Period	Immigrants	Emigrants	Net Gain
May 1924	32,985	6,634	26,351
April 1924	38,375	5,394	32,981
May 1923	52,809	5,752	47,057

UNITED STATES Hoffman Machinery Corporation, with Executive Offices in New York City and Factories in Syracuse, manufactures and sells steam pressing machines and similar equipment to tailor shops and clothing manufacturers throughout the world. Their business involves an immense amount of detail, about which complete information must be instantly available. That is why they have installed the Powers Equipment, shown in the photograph to the left, in their New York offices. A similar installation, consisting of 4 Automatic Punches, 1 Sorter, and 3 Printing Tabulators, is in use at their Syracuse plant.

"No other way to obtain the accuracy and speed"

IN a recent letter from W. H. North, Comptroller of the United States Hoffman Machinery Corporation, he describes the usefulness of their Powers Equipment as follows:

"The accounting work for which we use POWERS equipment is the following:

1. All of our cost accounting and inventory records at our factory and foundry, Syracuse.
2. Records of customers' notes receivable, of which we have at times as many as 80,000 outstanding.
3. Sales analysis.
4. The control of Branch Office inventories of machines and parts.

We believe there is no other way in which we could obtain the analysis of our operations with anything like the accuracy and speed that your methods afford. In our business we have so much detail to review. This is due to the fact that our machines are built entirely within our own plants. Machine shop costs are necessarily intricate if it is required to find the cost of each machine and part. Another reason for detailed analysis is the fact that we sell largely on installment contracts, the accounts of which have to be reviewed and checked in detail very frequently.

We wish to compliment you particularly on your service."

Hundreds of other firms in all lines of business are finding Powers Accounting Machine Systems just as useful and just as indispensable. They agree with Mr. North that "there is no other way in which they could obtain the analysis of their operations with anything like the accuracy and speed."

Send for Evdiecne of Powers Savings

Powers Equipment is saving actual dollars and cents as well as time for its users. The little book "EVIDENCE" tells the story of these savings, and describes how Powers Equipment is used. It will be sent you without obligation. Just fill out and mail the coupon to the right.

POWERS ACCOUNTING MACHINE CORPORATION

Technical Representatives in All Principal Cities

115 Broadway **New York, N. Y.**

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You may send me a copy of "Evidence"—without obligation. I want to learn bow other manufacturing concerns are saving real money by using Powers Equipment.

Name ....

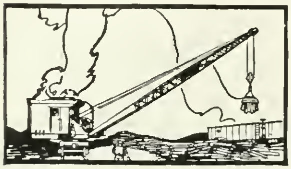
Position ....

Firm ....

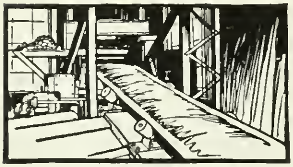
Street ....

City .... State ....

Put present plants on a better working basis!



Brownhoist makes locomotive cranes operated by steam, electricity and gasoline engine. Capacities from 5 to 40 tons.



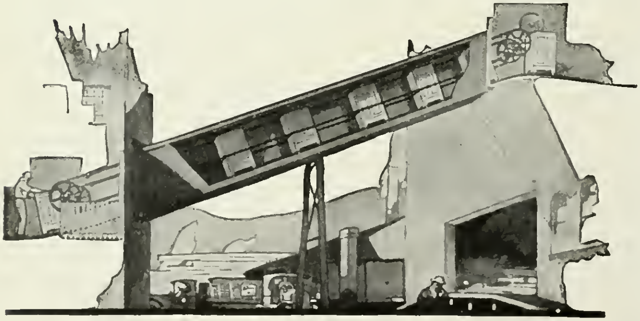
Brownhoist builds all standard types of belt and chain conveyors

MANY executives do not have at their disposal an "ideal" plant—designed and built for present day practice. Their job is rather that of getting maximum production out of the existing plant.

In such cases more economical routing and handling of materials will increase productive capacities—and will at the same time lower the cost per unit.

Brownhoist, as a pioneer in the material handling field, will gladly confer with executives who are confronted with a handling problem. And where better handling machinery is needed, Brownhoist equipment will quickly pay for itself out of the savings it creates.

With the same plant—150% increase in production



In the refrigerator plant of the Tennessee Furniture Corporation, improved routing and material handling methods resulted in an immediate increase of 150% in production "without extensive additions to floor space and at reduced unit cost."

Brownhoist Conveyor equipment, such as shown in the opposite sketch, is an important factor in this plant, in speeding up production and decreasing labor payrolls.

The Brown Hoisting Machinery Co., *Cleveland, Ohio*
Branches: New York, Chicago, Pittsburgh, San Francisco, New Orleans, London, Eng.

BROWNHOIST

MATERIAL HANDLING EQUIPMENT

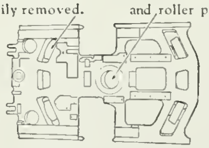
INDUSTRIAL

Why Industrials Excel

13 MASSIVE STEEL BASE

Without jacking up base, steel conical rollers easily removed.

Center pin nut adjusts all play between bedplate and roller path.

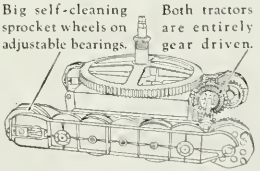


Entire upper machinery rests on a single massive steel rotating bedplate, insuring perfect alignment and preventing sticking clutches, undue gear wear and bent shafts.

14 HIGH TRACTOR ROLLERS

Big self-cleaning sprocket wheels on adjustable bearings.

Both tractors are entirely gear driven.



Tractor rollers, five on each side are 25 inches in diameter. These large rollers decrease the traveling friction and keep bearings high up out of all mud and dirt.

A 50-man-power masterpiece

THIS LATEST INDUSTRIAL crawling tractor locomotive crane is producing 50-man-power results in handling the heavy loads of industry. It is cutting deep into the high costs of manual material-handling and recovering a buried treasure of non-productive dollars.

The new type D is a masterpiece of design and construction. Its outstanding superiority is guaranteed by America's pioneer crane builders. Over fifty years of untarnished business integrity and highly specialized skill and experience form its background.

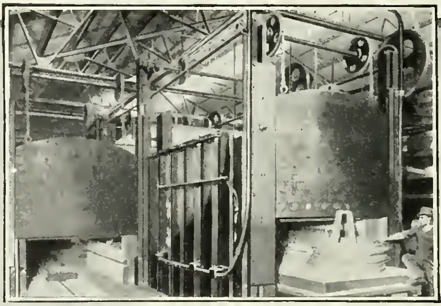
This newest INDUSTRIAL has a greater field of usefulness in industry than any other material-handling equipment on the market today. As a crawling tractor it goes everywhere. With its accessories, including clamshell bucket, electro-magnet, hook and block, shovel dipper arm, dragline bucket, wood grapple and pile driving leaders, it will conquer any material-handling problem at a tremendous saving in time and labor.

This latest INDUSTRIAL is fully described and illustrated in a 16-page bulletin just off the press. Ask for Book No. M-120 and it will be sent to you promptly.

INDUSTRIAL WORKS
BAY CITY - MICHIGAN
Locomotive Cranes, 5 to 200 Tons -- Transfer, Pillar & Gantry Cranes
Railway Pile Drivers -- Combination Crane Pile Drivers -- Transfer Tables
Portable Rail Saws -- Grab Buckets -- Magnets -- Steam Pile Hammers

INDUSTRIAL
CRAWLING TRACTOR CRANES

Firing vitreous enamel in a furnace equipped with G-E Direct-Heat Units and Automatic Control.



Compensating Type Electric Furnace equipped with G-E Direct-Heat Units, and Automatic Control

Smokeless, Flameless Heat

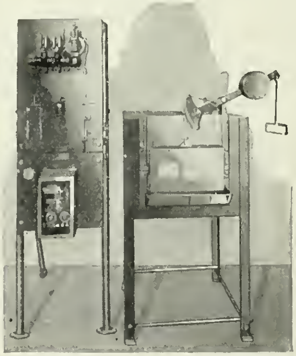
The old problems of Industrial Heating—combating combustion handicaps, uneven heat, rejections—no longer trouble the man who uses electric furnaces and ovens.

Vitreous enameling, attended by numerous disadvantages of old time methods, has been simplified and improved by the use of electric furnaces equipped with heating units of G-E Direct-Heat design. Temperature is easily maintained. There is no muffle to sag and break. The number of heats a day is increased, the quality of the product is higher, and rejections due to soot or fumes are unknown.

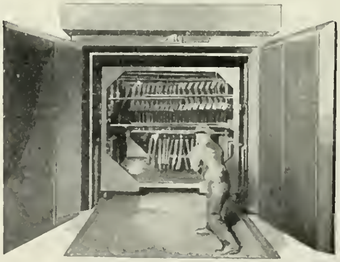
The electric compensating furnace for annealing is so arranged that the cooling charge coming out of the furnace preheats the cold charge on its way in. This furnace has proved especially valuable in annealing wire—greatly speeding production.

In the new G-E Direct-Heat Furnace, Type RRS, there is no muffle interposed between the resistor and the charge. The heat radiates direct to the charge, which makes heating quicker and control easier.

The General Electric Company also manufactures small electric heating devices—giving to industry the broad use of electricity for practically every heating purpose.



G-E Direct-Heat Furnace, Type RRS—for heat treating tools, heat treatment research in laboratory, and many other heat treating processes up to 2000° F.



For japan baking ovens the General Electric Company manufactures a complete line of electric heating equipment with automatic control

General Electric Company
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39-85

MANAGEMENT
AND
ADMINISTRATION

VOLUME VIII AUGUST, 1924 NUMBER 2

Building the Morale of the Working Force

By J. HOWELL CUMMINGS

President, John B. Stetson Company

Index Number
658.3 Employee morale

WELFARE work in the Stetson business was almost coincident with its founding, for John B. Stetson was an intensely human person, thoughtful of the physical and spiritual well-being of those associated with him, happy when they were enjoying happiness, and sympathetic in their troubles. From the very beginning of his business life he practiced "Welfare Work," although the term was perhaps not thought of at that time.

The first Stetson hat was made in 1865, when Mr. Stetson started with a capital of $100. There were difficulties to overcome, but the business prospered, and with the first employee began welfare work at Stetson's, because John B. Stetson believed in sharing success with those about him, and it was always his aim to make others contented in their work. The expression attributed to Stephen Girard was one of his favorites. He believed that "Sympathy is best expressed in terms of dollars and cents," and there are numerous instances where he helped in a most practical way, according to this principle. Mr. Stetson was a working man, acquainted with the problems of that class. He had no time for the shirker, but did appreciate the man who worked with a will.

J H Cummings

Many of the first employees were known to some of the men at present employed by the John B. Stetson Company, several of whom began as apprentices more than 50 years ago. Incidents of the early history of the business have been handed down, and the examples set by Mr. Stetson himself, and those who helped him, have made their impression on the whole present organization. He showed that a real interest in one's work was one of the big factors in doing that work well. It has become impressed upon Stetson employees to interest themselves in the work they do—to feel that every man or woman, boy or girl, is doing a responsible task that should not be slighted, and to realize that the work of one department is as important as that of another. The man who runs an elevator, or who keeps the workroom in order, knows that what he does has its bearing on the making of Stetson hats—he feels that he, too, is a hatter.

As the number of employees grew, it was, of course, impossible to maintain the close, personal relationship that existed between employer and employee in the early days, when the number of employees was comparatively small. At the same time, it has always been the aim of the management to keep up this spirit so far as it is possible to do so, with a pay-roll containing 5000 names.

When the first child was born to one of the first Stetson employees a new silver dollar was presented to the child as the nucleus of a savings account, and this practice was carried on for many years, so that it might be said this was the beginning of welfare work, as the term is commonly used.

It is not a matter of record when the first turkey was presented to employees, but from a time far beyond the memory of any of the present employees, at Christmas turkeys have been given to every married man, hats to single men, and candy and gloves to girls and women. At Christmas, 1923, there were given to employees 2813 turkeys weighing 42,195 lb., 1151 pairs of gloves, and 1000 lb. of candy.

The John B. Stetson Company has adopted three or four plans that are in the nature of profit-sharing plans, all based upon the merit system. A careful record of each employee is kept through the year, and at Christmas time he is rewarded according to his effort. All awards are made at the Christmas exercises in the large auditorium in the factory. (See Fig. 1).

At first the distributions were small, but each year they have grown in amount, in some years totaling as much as $550,000.

The bonus system, which has been so helpful in building up the efficiency of the skilled labor employed in manufacturing Stetson hats, was first introduced in 1898, in the sizing department, as a reward to employees of this department who had been punctual and constant in their attendance during the entire year. The bonus amounted to 5 per cent of their total wages for the year. Hatters had gained for themselves a rather unenviable reputation for uncertain attendance. Much time was lost in hat factories. When the bonus plan was put into effect there was an increase of 15 per cent in the number of employees who remained at work during that year; in other words a full attendance was obtained from 50 per cent in the sizing department against 35 per cent for the year 1897. This was considered sufficiently encouraging to justify an increase in the bonus to 10 per cent in 1899, and during that year 67 per cent of the sizers remained the entire year. The following year the record was 80 per cent. In 1901 the bonus was increased to 15 per cent and the attendance increased to 88 per cent. In 1903, when the bonus was increased to 20 per cent, for the first time 100 per cent of the men in the sizing department remained throughout the year. This included 1000 men and the record of 1903 has held good practically every year since then.

In 1905 the bonus plan was extended to include the women employed in the trimming department. Subsequently other departments were included, and in 1915 the plan was extended to take in all employees, who have been with the company six months or more. There is now paid to every employee a flat bonus of 10 per cent for the year ending October 31, payable at Christmas, *provided the employee has worked faithfully through the year.*

In 1902 the Board of Directors asked the stockholders to set aside 5000 shares of Common stock of the company, to be used by the president in rewarding employees who had given meritorious service.

The stock costs the employee nothing, being paid for by accruing dividends in about 5 years. After that the employee receives the dividends in full, but the stock is held in trust for him for a period of 15 years. If the employee leaves the company's service or is discharged for cause, he receives only as much of the *par* value of the stock as has accrued to date. If the employee is incapacitated for work, or dies, the stock is transferred to him or his estate when paid in full. The most prized possession of those employees who were among the first to receive shares of stock is the stock now matured and in their own hands. A large percentage of these employees, after having been awarded stock under this plan, have added to their holdings by purchasing stock on their own account, and their example has been followed by others, so that a very considerable number of employees are stockholders. It has always been felt that this plan has been instrumental in drawing into the establishment men of intelligence and ability who co-operate fully with the management.

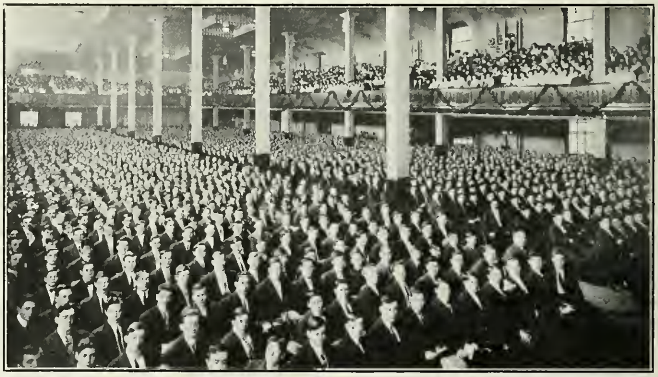

Fig. 1 Auditorium of the John B. Stetson Company

The company encourages employees to save, not however, through direct giving, but through a careful study of conditions and the adopting of plans which may be suggested from time to time. The Stetson Saving Fund started as a Christmas Club. When Christmas came, several employees had more than they cared to use and wished to leave it in the fund. The company agreed to pay them 5 per cent interest. The fund has now grown to large proportions and about one-third of the employees are depositors.

Through the Stetson Building and Loan Association, many employees have bought their own homes. For years this has been encouraged in every way. The home-owner is generally a dependable worker. Shares in the Building and Loan Association are among the awards made at Christmas, the company paying the monthly dues and the value of the shares being turned over to the employee at maturity of the stock.

Sick benefits are provided for by the Stetson Beneficial Association. All employees pay monthly dues of 25 cents, and in case of sickness receive $7 per week, after the first week, for 6 weeks in any one year. The general health of the employees is, however, so good that for a considerable period only 9 monthly payments have been made during the year.

Since 1919 the Group Life Insurance plan has been in effect. An employee of three months' standing receives a policy of $200. The amount is increased to $400 at the end of six months and to $500 at the end of one year. One hundred dollars is added annually thereafter, until the policy amounts to $1000. All foremen and assistant foremen receive double this amount. The superintendents and most of the older foremen have been given endowment policies under the plan.

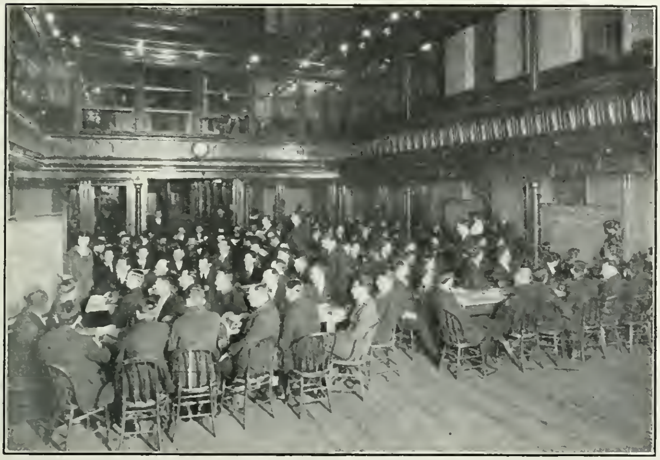

FIG. 2 AMERICANIZATION SCHOOL FOR THE BENEFIT OF ALIEN EMPLOYEES

As a means of recreation, an athletic field was opened in 1913. At noon time and on holidays the grounds are used for baseball, quoits, tennis, and other sports. The employees amuse themselves according to their inclinations, and the field is conducted more in the nature of a playground than an athletic field.

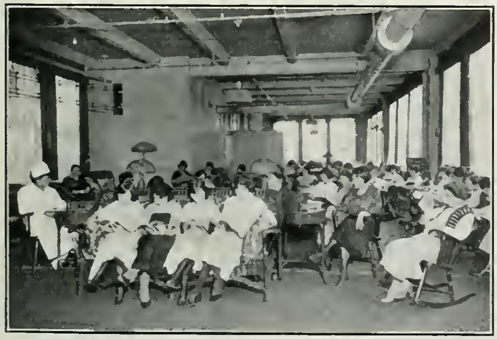

FIG. 3 GIRLS' RESTROOM

Two auditoriums are located in the factory, one with a seating capacity of 1800, and the other with a seating capacity of 5500. They are used for educational purposes, social gatherings, and the Stetson Sunday School. The one is the largest permanent auditorium in Philadelphia. It is equipped with a pipe-organ and is the scene of splendid musical concerts throughout the year, given by such organizations as the Philadelphia Orchestra and the Stetson Chorus. The chorus of 150 voices is under the direction of Dr. Adam Geible, well-known organist and composer.

The Sunday School, which meets in the auditorium, has an enrolment of about 1200, with an average attendance of over 900. The youth of the neighborhood are attracted to the school and the many organizations connected with it. For almost 40 years a noonday service has been held in the factory every Tuesday from 12.30 to 1 P. M. There is usually congregational singing, a solo, and 20-min. address by some prominent clergyman on a religious topic or on some subject of unusual interest.

One of the features of welfare work is the Americanization School, which is conducted in the smaller auditorium. (See Fig. 2.) Classes are conducted for the benefit of alien employees. The Company's motto is: "Every employee an American citizen, who can read, speak, and write the English language." At the present time there are practically no foreign-born employees who have not been naturalized, or declared their intention of being naturalized.

A first-aid room has been provided, where minor cases are treated. It is in charge of a graduate nurse. There is also a dental department where the cost of service is about one-third the usual charge. Careful attention has been given to cafeterias and restrooms. (See Fig. 3). To enable the employees to procure a wholesome lunch at little cost, the company has installed cafeterias located in different parts of the factory. Separate service is maintained for the men and women employees. Those who prefer to bring their own lunches are encouraged to eat them at the cafeteria tables, where they can rest with comfort and convenience.

The Stetson Hospital is the outgrowth of the opening of a small dispensary in 1887. It is thoroughly modern in its equipment and can accommodate from 60 to 70 patients. It administers to the public, generally. Any employee who needs hospital treatment may occupy a free bed in the ward or semi-private ward. If the employee desires to pay for service, the hospital and staff will deduct 33 1/3 per cent of the regular charge.

The company has spent and is still spending annually, great sums of money in its welfare work, but none of this is considered in any sense to be charity, either by officials or employees. It is simply an investment—an investment in good-will, health, skill, and efficiency. The company has acted consistently upon the principle—"The Better the Workman the Better the Work" and from the results that have been obtained it is convinced that the principle is the best possible one for a business to follow. The public, the employees and the company all are benefited by it.

Management Training Needed by Foremen

By E. H. FISH

WHEN we are sick and call a doctor we insist upon getting one that has been taught medicine, but in the shop we hire a foreman without even wondering if he has been trained to be a foreman.

There are probably close to a million foremen and sub-foremen in this country. Not one per cent of them have had any training whatever in their main job. Almost every one of them knows well enough the work over which he is foreman so that he can do it himself, but as for managing his men, which is really what he is paid to do, every man has his own ideas.

Problems in Handling Men

In very few plants do foremen get together and discuss ways of handling workmen. Go through any shop anywhere, without the foreman or superintendent, and you will see evidences of lax control: workmen scratching their heads trying to make out how it is that the foreman wanted them to do certain jobs; other men sulking because they think some one else has an easier job or gets more pay; men on day work kicking because they cannot get piece-work, and men on piece-work that want day work; men on jobs that nature never intended them to do; men without ambition, without satisfaction in the present, and without hope for the future.

You find one foreman whose whole life is bound up in the quality of the goods made; another whose sole idea is quantity; but neither one showing the least interest in the human being on whom he is dependent to attain his ends.

Who pays the bills for this waste? The stockholders, most of all, unless they have a sales department that can get a price high enough to pass the loss along to the public.

How can it be prevented? By giving the foreman at least a fraction of the training that business executives in other lines get. The art of managing men is not essentially different in a steel mill from what it is in a cotton mill, or a machine shop. The same man that is being managed in a rubber factory today is asking for a job next week in a foundry or a shoe shop. Getting his enthusiastic, energetic co-operation in production is not a different problem in one shop from that in the other.

In large shops foremen have been relieved of almost every duty except management. They get their men from an employment department, the work is parceled out by a planning department, it is passed on by an inspection department—and yet only a fraction of these large shops have ever trained their own foremen in management. It is not a foreman's fault if he does not know even the first principles of handling men, for there are no schools for him to attend, and no books on the subject for him to get from the library. Only a little really practical material is available in the trade papers. Therefore it is distinctly up to the management to provide a way for these men to learn the greatest essential to their work.

Index Number
658.31243 Foremen

The problems in handling workmen are as varied as the men themselves. No two want exactly the same thing, but their wants can all be classified under a few heads. They are:

1. Money.
2. Physical and mental comfort.
3. Steady work.
4. To be treated like men.
5. A reasonable chance for promotion.

Some foremen are allowed to grant wage increases; others can merely recommend; but there are only a few places where they have no influence, or where they cannot secure a raise for a man whom they consider deserving. Physical comfort does not mean that a man should expect not to get tired during the day, but it does mean that his foreman should prevent him from wasting his energies in doing lifting that can be done by power for a fraction of the cost.

Men want freedom from worry. They ought not to have to wonder every day whether the boss will be in an amiable frame of mind, or whether he will come in fighting mad. No man should be given work beyond his mental capacity. Yet every shop shows instances of men, successful on one job for a long time, who were promoted too rapidly, and to jobs so far beyond their mental capacity that they have broken down under them.

Steady work is sometimes beyond the province of the foreman. Still, there are many cases where the foreman might better have called on his gang for a little increased effort rather than put on additional men whom he knew he could promise only short-time jobs.

Being treated like a man may seem trite, something unnecessary to mention. But there are still frequent instances where foremen have not had their attention called to habits that were driving away desirable help.

Promotion Is the Most Important Factor

But, of all things, the reasonable chance for promotion cuts the largest figure. Any man who gets into a dead-end job and finds it out, wishes he could back up and begin over again, and many do, even though they have to accept less money while they are learning something new. Most dead-end jobs are without advancement because the foreman does not find an outlet, does not see that men want to work through them to something better. So much has been said in the past ten years about reducing labor turnover, that many people think it is the chief consideration of the employment question. They forget that the turnover may be cut down to the point where stagnation results. A condition worse than that of a high labor turnover is a low one produced by keeping men on jobs from which they should be promoted.

Organizing the Personnel for Production

Building Tractors Under Scientific Management—III

By GEORGE D. BABCOCK

Manufacturing Executive, Holt Manufacturing Company

WE have already described the work that was necessary at the Holt Company's works before a start could be made to begin to control the activities of the plant according to the principles of scientific management.[1] As the work proceeded, the problem shaped itself more clearly, and resolved into the following elements:

(*a*) The establishment of a functional organization, with the duties pertaining to each function clearly defined.
(*b*) The acquirement of exact knowledge concerning the limitations of the product and the methods of making it.
(*c*) The formulating of manufacturing programs that would enable the company to meet fully the expected demand for the product in the most economical manner, with a minimum of product and material tied up in inventory.
(*d*) Control of the material supply, to the end that there should never be a stoppage of production due to a shortage of material for any part of the product, and on the other hand, to avoid a surplus over and above the quantity needed for the manufacturing program. This last is important, for in times of stress many manufacturing companies find themselves embarrassed by reason of having their assets locked up in raw material which can only be liquidated by manufacture and sale of a product for which, at the moment, there may be little demand.
(*e*) The establishment of the best possible relations between the company and its employees. It was sought to establish a spirit that would cause every employee to state with pride that he was a "Holt man," and make him reluctant to work elsewhere unless conditions were the same as at "Holt's".

Observe how closely this program follows the principles of scientific management as set forth by Taylor. These principles have been many times published, but they are fundamental and cannot be repeated too often. Therefore we offer no apologies for again repeating them. Briefly they are:

1. Establishing the science governing all parts of the work.
2. Scientific selection of the workmen.
3. Scientific education and training of the workman.
4. Cordial co-operation between the management and the workers.

Index Number
658.3 Personnel management
658.5 Production control

In our program items (*b*) and (*e*) required the application of the first principle; items (*a*) and (*e*) involved the second. The third principle was applied also to item (*e*), for the reason that only when a man is fitted to his job and thoroughly understands it, does he take pride in it and remain contented in it. Item (*e*) also involves in its entirety the fourth principle. It is interesting to note that this program was not made to fit the principles, but was evolved from a study of the existing conditions. That these principles applied so closely to the complicated problem that had to be solved, is but another demonstration of their fundamental soundness and truth.

The Function of Forms

In working out the program we had at the same time to develop the system and forms to make the program effective. And let it be stated here that scientific management is not a particular system, nor a set of forms. These are but a means to an end. They represent only the easiest and most economical method of applying the principles of management to the case in hand. Two plants may have entirely different systems and their forms may be totally unlike, and still both plants may be truly representative examples of scientific management.

Forms are merely a permanent statement of the wishes of the management in regard to the matters to which they relate. They replace orders and instructions that at the early stages of an enterprise or program are given by written memoranda, or verbally. When an order or instruction is repeated sufficiently often to warrant it, a form is devised to convey the same information, concisely and definitely, leaving only the necessity of writing in the figures, dates, and symbols to make the form complete. Forms may also be considered a delegation of authority to the individual authorized to issue them, the authority, however, extending only to the subjects covered by the form. The more important forms, designed as our program was worked out, their relation to each other and their use, will be described as we consider the development of the system at the Holt plant.

The Organization of the Personnel

Fig. 12 is the organization chart of the manufacturing division of the Peoria plant. Here again all the functions first laid down by Taylor in his classic, "Shop Management" appear, although in somewhat different arrangement. The most noticeable difference is the absence of the "speed boss" and the "gang boss".

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[1] See MANAGEMENT AND ADMINISTRATION for June 1924, p. 647; July 1924, p. 19.

The "speed boss" has almost entirely disappeared from the literature of management, nor is the passing of the term to be regretted. It is probably responsible, more than any other one thing, for a large part of the opposition formerly expressed by labor against scientific management. The reasons for the passing of the speed boss are chiefly that the standardization of methods and the improvement in machinery have rendered him unnecessary. Analyses of jobs have led to standards of feeds and speeds that were not available in the early days of scientific management, and builders of machine tools have redesigned that product so that now these feeds and speeds, or ones very close to them, can be obtained on practically all machines. In the giving of jobs to the workmen the feed and speed best suited to the job are usually specified, and it is just as easy for the workman to use the correct combination as not to do so. In fact, the men have taken a keen interest in this matter. They have an instructive desire to be a party to all improvements, and have welcomed opportunities to use their training and native ability in cooperating in the solution of problems of production. Then, too, some of the work formerly assigned to the speed boss has passed to the line inspector, who, in his function of securing perfect workmanship, must instruct the workman, if necessary, in the handling of his machine.

The duties of the gang boss still remain, but are discharged by the foreman in charge of each group of workmen. These duties comprise general oversight of the work of the men, including the setting up of their machines and the assurance that there is work ahead of each man, although the actual control of the movement of work is lodged in the dispatching division.

The Producing Division

In the Holt plant the producing division has replaced the earlier form of shop organization. In the producing division are the general foremen and sub-foremen, reporting to the factory manager, who is responsible to the manufacturing executive for all production. In this division the various departments are functionalized as far as possible. Foundry, machine shops, and assembly are the major departments, each under its own head. Within these departments, particularly in the machine shop, the work is still further functionalized whenever functionalization is advantageous. Certain parts of the tractor can best be built on the principle of progressive manufacturing, and for such cases a section of the shop is organized as a separate function, each under the direction of a foreman. Other parts of the tractor which are not in sufficient volume to be made continuously are routed to the machine departments in the order that these are concerned in the manufacture. Each machine department, such as turret lathe, drilling machines, etc., constitutes, from the organization standpoint, a separate function. (See Figs. 13, 14 and 15.)

This is in true accord with the principles of scientific management, which requires that each function be discharged by an individual who is especially qualified to do so. In each section of the shop that operates as a function are men who are much better trained to handle the machines and work in that section than in any other. This is due to two causes. The system of rating in force furnishes an incentive for them to become more skilled in the work of the department to which they are assigned. Foremen and inspectors are encouraged and required to assist and instruct their men at all times to the end that they may become better workmen.

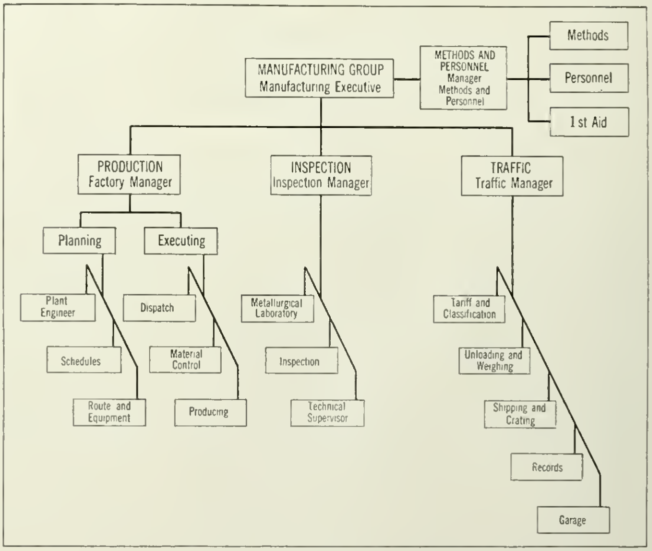

FIG. 12 ORGANIZATION CHART OF THE MANUFACTURING DIVISION OF THE PEORIA PLANT

The second reason is found in the fact that Peoria is located in the center of an agricultural district, with no large market of skilled mechanics upon which to draw. The great majority of the men employed in the Holt plant have been trained in the plant, their training having been started under the stress of war production. Under such conditions, there was little or no time to teach a man anything but how to do the one job to which he was assigned. Then they learned to run but one type of machine, or at best two. Such a procedure was not one to turn out all-around, high-grade machinists, but it did create a large number of specialists. With the return of peace, and the cutting down of the labor force, the best of these specialists naturally remained on the pay-roll. The policy of the company to encourage its men to qualify for a higher rating tended to improve the average ability. The result is that at the present time each specialized department of the plant has a body of workers that will bear comparison with similar workers in any part of the world. And the remarkable thing is that these workers have been built up from a community that has no industrial or mechanical background.

Under such conditions, functionalizing the shop was the natural policy, and has been of benefit both to the men and the company. The men are able to earn more as high-grade specialists than they could as mediocre all-around mechanics. The company benefits in the relatively high output of such men, which lowers its unit costs. It benefits still further from the fact that the capabilities of the men are well known, and their work can be scheduled with exact knowledge that it will be finished and available when wanted. This has been one of the potent factors in hanging up the production record of which the Holt organization is so proud.

Nor is the fact that the men are specialists on one or two machines, only, any detriment to them should they desire to seek other employment. So well trained are they that they are in constant demand by other industries in the Peoria district. The statement of a workman that he is from "Holt's" is usually sufficient to put him on a pay-roll without further formalities.

The Productive Functions

Returning now to the other functions of the organization, Taylor had a function which he called "order-of-work". In the Holt organization, we have this function, but we have subdivided it into three parts, viz., material control, schedules, and dispatching. Our route and equipment division corresponds almost exactly to Taylor's function of routing. The Taylor function of inspection also is present, but more highly developed than even Taylor's conception of it. The original function of repair under the "repair-boss" has become the maintenance department, and the "repair-boss" is now the plant engineer.

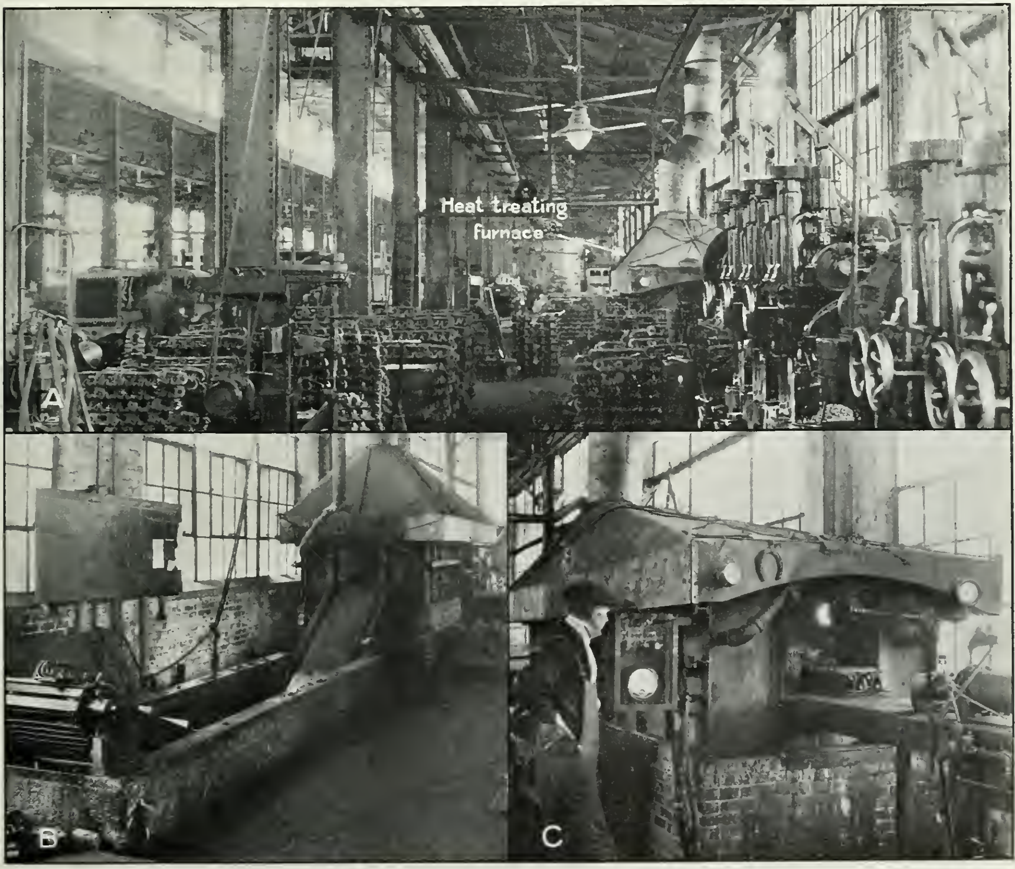

FIG. 13. A DEPARTMENT ARRANGED FOR PROGRESSIVE MANUFACTURE

(a) The track shoe job, which consists of rough grinding, drilling, heat-treating and quenching; (b) discharge end of heat-treating furnace, and quenching tank; (c) entrance to heat-treating furnace.

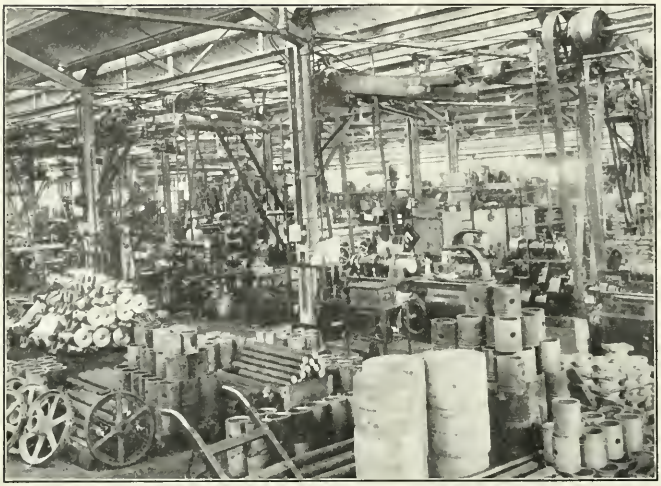

FIG. 14 CONDITIONS IN MACHINE SHOP AT CLOSE OF WAR

Two of Taylor's original functions have not yet been considered. These are those of discipline and cost-keeping. In the Holt plant, as in all others in modern industry that make any pretence of keeping up with the procession, these functions have been expanded to entire departments and have an importance far exceeding that which was first ascribed to them. The duties of the "disciplinarian" in the original functional organization were the imposition of fines for infractions of company rules, and the adjustment of differences between the workmen and their immediate superiors, and between one another. He did all the firing, and sometimes the hiring also.

The Personnel Department

Today the personnel department has all the duties of the old disciplinarian and many more, which cause the relations of management and men to approach the idea set up when functional management was first conceived. The personnel department not only hires men, it finds out the class of work for which they appear to be best fitted, and sees that they are assigned to that work. Once at work, the interest of the personnel department in the man does not end. It watches his performance week by week and records it. Should the man fail to measure up to the standard set for him, the personnel department gets after his foreman to ascertain the reason. If it is lack of understanding of his work, the foreman must pay more attention to him until he does understand. If the equipment he is using is out of repair, the foreman must see to it that the maintenance department takes immediate steps to correct the fault. Should the man persistently fail to reach the standard of his class, he is not then summarily dismissed. Effort is made to find a place in some other department where he will make good. Not until he has clearly demonstrated that he is not the caliber of man desired in the plant, is the company ready to sacrifice the expense it has incurred in attempting to train him.

On the other hand, should the workman's record show that he is steadily improving in ability and performance, the personnel department advances his rating. With the advance in rating an increase in wages automatically follows. A man does not have to ask for higher wages. He fixes his own wages, within the limits set for his class by his performance, and his weekly record in the personnel department shows when he should be advanced.

Fig. 16 illustrates the records maintained by the personnel department. It will be observed that these are kept in great detail. The numbered spaces at the top of the card serve two purposes. They are first an index of the weeks of the year for the plotting of the man's performance in the shop. They also are used to show the classes of work to which the man is fitted. Each class of work done in the shop is given a number, and a colored signal is attached to the corresponding number on the card. The different colors of the signals indicate the rating of the man in his class.

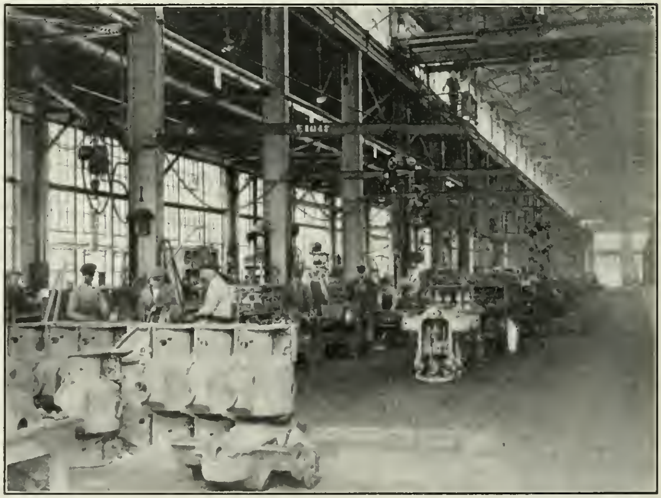

FIG. 15 CONDITIONS IN MACHINE SHOP UNDER SCIENTIFIC MANAGEMENT

In regard to rating, the following system has been adopted. For each job in the shop a standard time for its performance has been set. The method of doing this is explained later. A man whose performance for a period of 12 weeks shows a time that averages 70 per cent of the standard time, is rated as a first-class man. A man whose average time for his work is less than standard time, but more than 70 per cent of standard, is rated as a second-class man. A man who consistently averages more than standard time, is rated as third-class. This method of rating has proved very satisfactory both to the men and to the company.

The rating is determined graphically by plotting the performance each week, as shown by the job tickets issued to the men. These job tickets show the time allowed, and when the work has been completed, the time taken for the job. The performance of the man is expressed as a percentage, found by dividing the elapsed time by the standard time. These percentages are then plotted. The standard time is indicated by a red line printed on the personnel record, and performances of less than standard time show above the red line, while those greater than standard appear below it.

The personnel department is the judge in cases of difference between the foremen and their men. No foreman has power to dismiss a man from the company's employ for any reason whatsoever. Poor workmanship, infractions of shop rules, insubordination, all must be referred to the personnel department. An investigation of each case is then made, and the course to be pursued is determined. Poor workmanship may be the result of a man being improperly placed. A transfer to some other department or class of work will often show a man, whose record kept him on the verge of dismissal, to be a first-class man in his new surroundings. Under the order that only too often prevails in industry, where a foreman has the power of summary discharge, the company would have lost the services of a really valuable man, and would have gained a certain amount of ill-will. This ill-will might easily extend to the man's fellow employees, especially if they should feel that an injustice had been done. A feeling of good-will toward a company by the workers in a community is an asset of no mean value, and should be fostered by every means possible.

The foremen, however, have the power to dismiss a man from their own departments. This is done by a "recommendation for transfer" addressed to the personnel department. If the reasons supporting this recommendation are sufficiently strong, the man may be dismissed permanently, or else he is transferred to

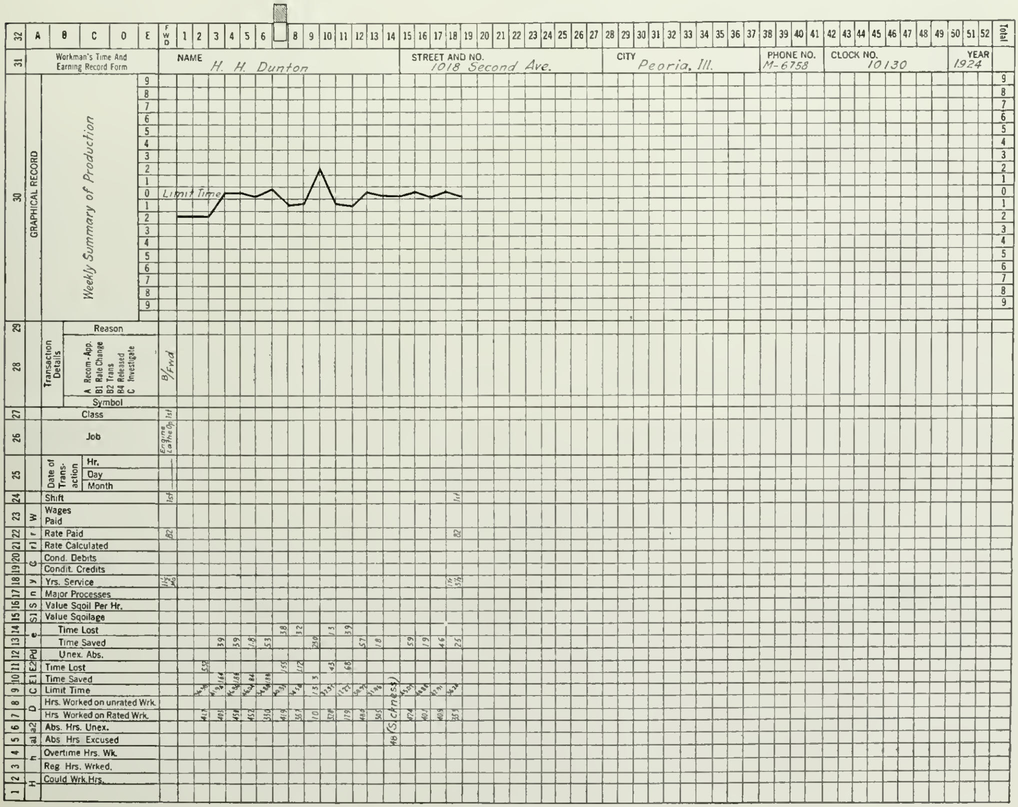
Workman's Time And Earning Record Form
NAME H. H. Dunton
STREET AND NO. 1018 Second Ave.
CITY Peoria, Ill.
PHONE NO. M-6758
CLOCK NO. 10130
YEAR 1924
Class 1st
Job Engine Lathe Op.
Shift 1st
Rate Paid 82
GRAPHICAL RECORD
Weekly Summary of Production
Limit Time
Transaction Details
Reason
A Recom.-App.
B1 Rate Change
B2 Trans
B4 Released
C Investigate
Symbol
B/Fwd
Date of Transaction
Hr.
Day
Month
Wages Paid
Rate Calculated
Cond. Debits
Condit. Credits
Yrs. Service
Major Processes
Value Sqoil Per Hr.
Value Sqoilage
Time Lost
Time Saved
Unex. Abs.
Limit Time
Hrs. Worked on unrated Wrk.
Hrs. Worked on Rated Wrk.
Abs. Hrs. Unex.
Abs. Hrs. Excused
Overtime Hrs. Wk.
Reg. Hrs. Wrked.
Could Wrk. Hrs.
(Sickness)
Total

FIG. 16 WORKMAN'S TIME AND EARNING RECORD FORM

some other division of the plant. The removal of the power of discharge prevents injustice to the men. Human nature is strong, and foremen are only human. Personal dislikes and grudges in many organizations are satisfied by narrow-minded men clothed with brief authority, and in the end the company is the chief loser. There is no reflection on the foremen of our organization intended or implied by the foregoing observations. We believe that they are in thorough sympathy with the aims of the company in regard to its men, and that such criticisms as they may be compelled to make from time to time, are entirely impersonal, and are dictated with a high regard for the standards set. But we feel that it is wise so to organize matters that no one can do an injustice either wilfully or unconsciously.

After the personnel department has made its decision in any case coming to it from the shop, the men, if they feel that injustice has been done, have the right of appeal to the manufacturing executive. It is worthy of note, however, that this right is seldom exercised. It will be observed in the organization chart that the personnel department is not a function of the production department, but is entirely independent, responsible directly to the manufacturing executive. Its actions then are not hampered by considerations of the effect of its acts on production, and it can make all decisions strictly on the merits of the cases presented to it.

It should be noted here that the personnel department does nothing that could be called "welfare work". The company believes that its relation to its employees should be of a business character only, and that interference in the activities of the men outside of the plant are unwarranted and detrimental both to it and to the men.

The company believes that its dealings with its men should be on the same plane as its dealings with concerns from whom it purchases material. The only difference between the two is that in one case it is buying commodities and in the other it is paying for services. It aims in both cases to pay in full for the value it has received, and at the same time to receive full value for the money it pays out.

There is no doubt that this policy has had much to do with the success of the production program. The men have realized that all that is expected of them is an honest effort to meet the standards set, and that these standards are fair both to them and the company. They further realize that the company is making every possible effort to assist them in meeting the standards. It has become plainly evident to us that fair dealing and exact justice to our men will meet with the same response from them.

The Importance of the Human Element

We have dwelt at some length on the human element in the plant for the reason that after all it is the human element that finally makes the product. The best system and the finest machinery in the world will not achieve results, unless the workers form an organization that is on a par with the system and equipment. And more than this, the executive end of the organization must be on the same high plane. The executive must learn that natural ability alone cannot compete with natural ability plus applied science.

This fact spells the death knell of "common sense" management. For in the past 20 years the principles of the science of management have been developing until now the fundamental ones are as firmly fixed as are those of electricity and steam engineering. The "common sense" manager must take these principles into account. We do not mean to convey the idea, however, that common sense and natural ability for management have no place in industry. On the contrary they are of the highest importance. In fact, the man who would not prove a good manager under the old method, seldom will prove to be one under the new. Scientific management cannot be administered by blindly following certain rules and principles. It must take into consideration the human element. And it is his knowledge of the human element that makes the "common sense" manager as efficient as he is.

In the development of the personnel relations, great credit must be given to R. M. Hudson, who joined the organization shortly after the writer. Since Mr. Hudson's retirement from this work, it has been carried on in an able manner by R. S. Weaver.

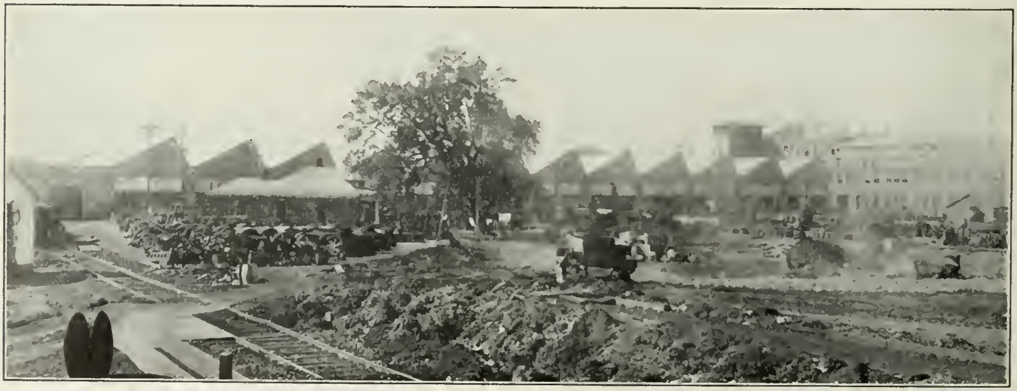

FIG. 17 CONDITION OF GROUNDS AT CLOSE OF WAR

A Method of Balance Sheet Analysis

By STEPHEN GILMAN

WHAT is the purpose of balance sheet analysis? Its purpose is to bring to light information which the balance sheet figures do not clearly reveal. Just as the doctor's diagnosis develops facts, which would not be apparent even to his skilled eye through mere observation, so does balance sheet analysis shed light on hidden business symptoms which mere inspection of the actual figures would not discover.

Who are interested in balance sheet analysis?

The corporate executive is interested in maintaining a proper financial balance in his business so that sudden economic changes may not find its financial position distorted with possible insolvency ahead. The banker, the investor, and the credit man are interested as actual or prospective creditors. And the accountant, either public or private, is interested because through such analysis he can make his service just that much more valuable. He who can interpret figures performs a more important service than he who merely compiles or verifies them.

The need for balance sheet analysis is based upon the known fact that the financial position of every business is constantly changing either for better or worse. Distortion of financial position means that the various classes of balance sheet items do not bear their proper relationship to each other. It is for indication of such distortion that the balance sheet reader searches. From this viewpoint, therefore, the problem is not one of studying the actual amounts shown on the balance sheet, but rather one of relationships between the classes of items composing the statement.

Methods of Analysis

Writers on balance sheet analysis have approached the subject from two different viewpoints. One plan compares a given balance sheet with the balance sheets of other companies engaged in the same line of business. The other plan compares a given balance sheet with earlier balance sheets of the same company. Under the first plan an attempt is made to determine a normal balance sheet for each kind of business to be used as a standard of comparison. The second plan involves a comparison of a series of balance sheets of the same company for the purpose of discovering *trends*. The second plan, only, is considered in the present article.

There are two methods by which analysis under the second plan may be accomplished:

1. The "ratio method".
2. The method to be explained in this article which we may call the "index method".

Under the ratio method a number of relationships of ratios have been worked out. These are constructed for successive balance sheets of this same company and are then compared to see if any definite trends are to be found. This method of balance sheet analysis undoubtedly started with the old-time banker and credit man with whom the beginning and end of balance sheet analysis was the comparison of the current liabilities with the current assets.

Index Number
657.36 Balance sheets

Ratios Commonly Used

A great many different ratios have been proposed, but the ones that seem to possess the greatest merit are as follows:

1. Quick assets to current liabilities.
2. Quick assets and inventories to current liabilities.
3. Sales to receivables.
4. Sales to inventory.
5. Sales to net worth.
6. Net worth to fixed assets.
7. Net worth to total liabilities.
8. Sales to tangible fixed assets.

Strictly speaking, numbers 3, 4, 5, and 8 are not truly balance sheet ratios since they introduce the element of sales which of course is not a balance sheet item.

While the ratio method has proved very valuable, still there are certain strong objections to it. These are as follows:

1. Any balance sheet ratio represents a relationship between two varying factors and any change in a ratio from one year to another must be interpreted by an examination of the changes in the two items from which the ratio is built.
2. The ratio method is cumbersome in its diagnosis of positive symptoms. In many instances the *method* of analysis appears to be of greater importance to authors than the *purpose* of such analysis.
3. The ratio is so artificial a figure that it is difficult for the analyst to keep in mind its connection with the actual balance sheet under survey.
4. The ratios give an unwarranted impression of finality whereas, as a matter of fact, the different ratios vary greatly in their reliability as indexes.
5. The method does not show trends of classes of items but merely trends of ratios.
6. In studying balance sheets by the ratio method it is difficult to obtain a bird's-eye view of the relation of various trends to one another.

The first objection is self-evident. If the quick assets of a company in one year amount to $10,000 and the current liabilities are $5000 the ratio is 200 per cent. If the next year quick assets remain at $10,000 and the current liabilities fall to $2500, the ratio is 400 per cent.

But the ratio is *also* 400 per cent if the liabilities remain at $5000 and the quick assets increase to $20,000. This means that the ratio method of balance sheet analysis requires a continuous comparison back and forth with the actual balance sheet figures.

The second objection has to do with the *purpose* of the analysis. If balance sheet analysis has as its purpose the diagnosis of business ailments, then those business ailments should be capable of being specified, and some definite connection between them and the ratios established. This can be done to some extent, but it is cumbersome, and writers on the subject have not developed this angle. Without such definite relationships between the ratios and the business ailments which they are presumed to diagnose much balance sheet analysis work is meaningless.

Standard Ratios

Those who favor the ratio method of analysis may conceivably admit all of the above objections to its use in historical analysis, i. e., analysis of successive balance sheets of the same company, and still claim the method valuable because of the possibility of securing standard ratios. The standard ratio is an average (arithmetic or modal) of the ratios of a number of different companies engaged in the same line of business. Such standard ratios are presumed to be a sort of measuring stick with which to compare the ratios of any similar company.

There is a small amount of truth in this claim, but as a matter of fact it is extremely doubtful whether standard ratios are very practicable. This is so because the balance sheet ratios of any company depend upon a number of factors which are the result of business policies and are influenced by the size of the company, its geographical location and other factors.

Alexander Wall, Secretary of the Robert Morris Associates, found it necessary to divide the United States into nine divisions and to determine standard balance sheet ratios for each separately. This indicates that a very large number of balance sheets of similar companies are necessary in order to obtain dependable averages. Procuring such a large number of balance sheets is a difficult task, unless handled by an association or governmental body.

J. H. Bliss, author of "Financial and Operating Ratios in Management," analyzed 230 companies falling into 42 groups. Some of the groups include but 1, 2, and 3 companies. His largest group of companies whose figures were available for determining the ratio of sales to inventory was 12. This would seem to be an entirely inadequate number of instances to serve as the basis for a standard ratio.

Failure statistics tell us that the mortality among business concerns is very heavy. Figures have been published showing very small chances of life of more than 15 years among manufacturers, wholesalers, and retailers. Also we know that most business concerns are small. The 1919 statistics as quoted by Lincoln in "Applied Business Finance" show that 79.6 per cent of manufacturing concerns reported gross sales of less than $100,000. Furthermore nearly one-third of all industrial organizations in that same year showed deficits. Under such circumstances if a large number of balance sheets are collected for standard ratio purposes, they are likely to include a heavy proportion of small or unsuccessful concerns and the resulting average ratios must be misleading if used as a standard. And last, but not least, standard accounting classification throughout an industry is almost essential before reliable standard ratios can be hoped for.

It is safe, therefore, to draw the conclusion that the standard ratio is an unattainable ideal except in those few instances where:

1. The figures are collected by an association or governmental body.
2. Classification of accounts is uniform with the contributing companies.
3. The number of financially sound contributors is large.

Ordinarily, the balance sheet analyst must depend upon historical analysis, i. e., the analysis of successive balance sheets of the same company for the purpose of finding trends. Because of this fact the following method is proposed to overcome the disadvantages which exist in the ratio method of analysis. This is in effect the "index number method" used by statisticians, applied to the field of balance sheet analysis. There is nothing new about this method, but the author believes that its application to balance sheet analysis is new and is very decidedly worth while.

The method is simple. It first involves grouping the various items of assets and liabilities for the various years into appropriate classes such as:

1. Quick assets.
2. Inventories.
3. Fixed assets (tangible).
4. Current liabilities.
5. Long-time liabilities.
6. Net worth.

The next step is to divide the total of each class for each year by the total of that same class for the first year of the series of years under review. This converts all of the actual figures into percentages based on the first year figures.

Application of Methods

The application of the two methods to an actual series of balance sheets follows in Table 1.

Analyzing the above by the ratio method we get the results shown in Table 2.

Certain definite conclusions regarding the trend of affairs with the Ames Manufacturing Company can be reached by studying the above tabulation, but obviously the same conclusions can more easily, quickly, and certainly be reached by a glance at the "index method" shown in Table 3.

Which of these two tables tells the clearest story?

TABLE 1. COMPARISON OF BALANCE SHEETS

as of January 1, Ames Manufacturing Company

	1921	1922	1923	1924
Assets				
Cash	$4,652	$13,371	$7,190	$10,512
Accounts Receivable (net)	14,468	8,217	5,629	5,857
Total Quick Assets	$19,120	$21,588	$12,819	$16,369
Inventories	17,556	20,607	28,077	22,210
Total Quick Assets and Inventories	$36,676	$42,195	$40,896	$38,579
Fixed Assets (less Depreciation)	17,922	25,707	36,163	37,290
Prepaid Expense	76	213	2,545	2,459
Total Assets	$54,674	$68,115	$79,604	$78,328
Liabilities				
Notes Payable—Trade	$1,000	. .	$3,000	$1,000
Notes Payable—Bank	4,000	$4,000	3,000	2,000
Accounts Payable	7,000	4,000	8,000	5,000
Dividends Payable	2,000	. . . .	2,000	2,000
Accrued Liabilities	128	690	337	248
Current (and Total) Liabilities	$14,128	$8,690	$16,337	$10,248
Capital Stock Outstanding	$50,000	$50,000	$50,000	$50,000
Surplus or (*) Deficit	*9,454	9,425	13,267	18,080
Total Net Worth	$40,546	$59,425	$63,267	$68,080
Total Liabilities and Net Worth	$54,674	$68,115	$79,604	$78,328
Sales	$52,088	$66,383	$90,652	$96,691

TABLE 2. ANALYSIS BY RATIOS OF TABLE 1

RATIOS	1921	1922	1923	1924
Quick Assets to Current Liabilities	$\frac{\$19120}{\$14128}=135.3\%$	$\frac{\$21588}{\$8690}=248.4\%$	$\frac{\$12819}{\$16337}=78.4\%$	$\frac{\$16369}{\$10248}=159.7\%$
Quick Assets and Inventories to Current Liabilities	$\frac{\$36676}{\$14128}=259.6\%$	$\frac{\$42195}{\$8690}=485.6\%$	$\frac{\$40896}{\$16337}=250.3\%$	$\frac{\$38579}{\$10248}=376.4\%$
Sales to Receivables	$\frac{\$52088}{\$14468}=360.0\%$	$\frac{\$66383}{\$8217}=807.9\%$	$\frac{\$90652}{\$5629}=1610.4\%$	$\frac{\$96691}{\$5857}=1650.9\%$
Sales to Inventory	$\frac{\$52088}{\$17556}=296.7\%$	$\frac{\$66383}{\$20607}=322.1\%$	$\frac{\$90652}{\$28077}=322.9\%$	$\frac{\$96691}{\$22210}=435.3\%$
Sales to Net Worth	$\frac{\$52088}{\$40546}=128.5\%$	$\frac{\$66383}{\$59425}=111.7\%$	$\frac{\$90652}{\$63267}=143.3\%$	$\frac{\$96691}{\$68080}=142.0\%$
Net Worth to Fixed Assets	$\frac{\$40546}{\$17922}=226.2\%$	$\frac{\$59425}{\$25707}=231.2\%$	$\frac{\$63267}{\$36163}=174.9\%$	$\frac{\$68080}{\$37290}=182.6\%$
Net Worth to Liabilities	$\frac{\$40546}{\$14128}=287.0\%$	$\frac{\$59425}{\$8690}=683.8\%$	$\frac{\$63267}{\$16337}=387.3\%$	$\frac{\$68080}{\$10248}=664.3\%$
Sales to Fixed Assets	$\frac{\$52088}{\$17922}=290.7\%$	$\frac{\$66383}{\$25707}=258.2\%$	$\frac{\$90652}{\$36163}=250.7\%$	$\frac{\$96691}{\$37290}=259.3\%$

TABLE 3 COMPARISON OF BALANCE SHEETS

as of January 1, Ames Manufacturing Company

Based on percentage of 1921 figures (index method)

	1921 ACTUAL	1921 PERCENTAGE OF 1921	1922 PERCENTAGE OF 1921	1923 PERCENTAGE OF 1921	1924 PERCENTAGE OF 1921
Assets					
Quick Assets	$19,120	100	112.9	67.9	85.6
Inventories	17,556	100	117.3	159.9	126.5
Quick Assets and Inventories	36,676	100	115.1	111.5	105.2
Fixed Assets	17,922	100	144.4	201.7	208.0
Prepaid Expense (omitted) Total Assets	$54,674	100	124.5	145.5	143.2
Liabilities					
Current Liabilities (also total)	$14,128	100	61.5	115.6	72.5
Net Worth	40,546	100	146.6	156.0	167.9
Total Liabilities and Net Worth	$54,674	100	124.5	145.5	143.2
Sales	$52,088	100	127.4	174.0	185.6

They both tell the same story but the index method tells it at a glance while the table of ratios requires considerable study before the good and bad trends are manifest. Clearly the company shows a tendency toward overinvestment in fixed assets which have increased to 208 per cent in 1924 as compared with an increase in sales to 185.6 per cent and an increase in net worth to 167.9 per cent.

Comparison of Balance Sheets

This is a straightforward and easily interpreted method as compared with the ratio method which requires analysis of the following figures:

Ratio	*1921* *Per cent*	*1922* *Per cent*	*1923* *Per cent*	*1924* *Per cent*
Net worth to Fixed Assets	226.2	231.2	174.9	182.6
Sales to Fixed Assets	290.7	258.2	250.7	259.3

As further evidence of the greater value of the proposed index method, examine the following comparative balance sheet, Table 4, and the accompanying analysis, Table 5.

The increase to 210 per cent in current liabilities as compared with only 122 per cent in net worth is a danger signal showing that the company has greatly increased the financing of itself through its creditors. The decrease in quick assets and inventories to 93 per cent and the increase of fixed assets to 236 per cent show a decidedly unfavorable trend. As a matter of fact the company (to which we have given a fictitious name) became insolvent shortly after the date of the last balance sheet.

Advantages of the Index Method

Other examples could be given to illustrate the use of this method of analysis, but the final conclusion would be unchanged. Both methods of analysis tell the same story, but it is a very important point that the index method tells the story quickly and by mere inspection, while the ratio method tells it in an involved way requiring real study to get the facts.

Advantages of New Method of Balance Sheet Analysis

This new method of balance sheet analysis has advantages as follows:

1. Facts are presented comparatively.
2. The trends of classes of balance sheet items are shown vividly.
3. It is easier to visualize several trends at one time, i. e., it furnishes a "bird's-eye view".
4. The figures are easier to interpret.
5. Less highly trained help is required to work out the figures for analysis.

TABLE 4 COMPARISON OF BALANCE SHEETS
as of the dates shown, Steel Products Company

	DECEMBER 31, 1916	DECEMBER 31, 1917	DECEMBER 31, 1919	SEPTEMBER 28, 1920
Assets				
Cash	$18,565	$13,717	$52,178	$445
Notes and Accounts Receivable	176,551	175,536	239,123	271,517
Quick Assets	$195,116	$189,253	$291,301	$271,962
Inventories	307,965	535,684	548,379	198,094
Quick Assets and Inventories	$503,081	$724,937	$839,680	$470,056
Fixed Assets	292,955	544,605	574,066	693,264
Total Assets	$796,036	$1,269,542	$1,413,746	$1,163,320
Liabilities and Capital				
Current Liabilities	$215,386	$386,218	$497,856	$452,810
Net Worth	580,650	883,324	915,890	710,510
Total	$796,036	$1,269,542	$1,413,746	$1,163,320

TABLE 5 COMPARISON OF BALANCE SHEETS
as of the date shown, Steel Products Company
Based on percentages of 1916 figures (index method)

	DECEMBER 31, 1916	DECEMBER 31, 1917	DECEMBER 31, 1919	SEPTEMBER 28, 1920
Assets				
Quick Assets	$195,116	96.9%	149.2%	139.3%
Inventories	307,965	173.9	178.0	64.3
Quick Assets and Inventories	$503,081	144.1%	166.9%	93.4%
Fixed Assets	292,955	185.9	195.9	236.6
Total Assets	$796,036	159.4%	177.5%	146.1%
Liabilities and Capital				
Current Liabilities	$215,386	179.3%	231.1%	210.2%
Net Worth	580,650	152.1	157.7	122.3
Total	$796,036	159.4%	177.5%	146.1%

This index method has none of the disadvantages and has every advantage of the ratio method as far as the analysis of successive balance sheets of the same company is concerned.

Conclusion

The first hasty objection to the method might have to do with the selection of the basic year, i. e., in the above example the year 1916. The claim might be made that it is not a normal or typical year. This objection, however, is not sound because the method does not pretend to show variations from normal but rather to show in a simple comparative way changes and trends, for which purpose the figures of any year may be used as 100 per cent.

In only a small percentage of instances can reliable standard ratios be obtained so that for the everyday use of accountants, executives, credit men, bankers, and investors this new index method is much more suitable and practicable than the ratio method.

Serving Hot Lunches Throughout the Plant

MEN in outlying points in a large plant are more willing to invest in hot lunches from the plant dining-room if they can have the lunches served where they work. The necessity of a long trip to the dining-room reduces the number of patrons. Men in many departments, also, are unwilling to enter the main dining-room without changing their dusty clothes, and the change takes too much time. Yet hot lunches benefit these men as much as they benefit other employees in the plant.

An economical means of bringing lunches to such workmen is worth while in terms of comfort and production. Speed is the main element in keeping food hot during transportation, and this requirement is met by the industrial truck or tractor.

Consequently, at the noon hour one establishment routes an industrial truck, shown in Fig. 1, to the kitchen of the main dining-room, and it is loaded with trays containing cans of hot stew, meats, vegetables, and so on. The truck is then run to outlying parts of the plant where the cans or trays are lifted out upon work tables or upon kitchen tables set aside in some clean corner or small room. In the department at the end of the route the truck itself remains and becomes the serving table from which the men get their meals.

Index Number
658.3835 Lunches

The convenience and satisfaction of having a warm, freshly-cooked, and appetizing meal at noon hour fits men to handle their afternoon work with the same energy they display in the morning.

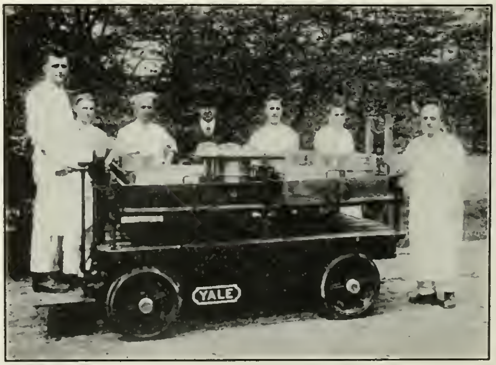

FIG. 1 INDUSTRIAL LUNCH WAGON

Classifying the Elements of Work

Methods of Analyzing Work Into Seventeen Subdivisions

By FRANK B. GILBRETH and L. M. GILBRETH

Consulting Engineers

THIS paper presents a complete method of visualizing a classification of all the subdivisions and the true motion-study elements of The One Best Way to Do Work.

Need for Such a Classification

Such a classification is vitally necessary, in order that fundamental superstandards shall be made by the scientific method of selecting and measuring the best units, for synthesis into methods of least waste.

This classification furnishes the basis of a definite mnemonic classification for filing all motion-study and time-study data for the work of the industrial engineer, the machine designer, and the behavior phychologist—that their various pieces of information, usually obtained through entirely different channels and methods of attack, may be automatically brought together, to the same filing folders, under the same filing subdivisions.

So far as we are able to learn, there are no other classifications or bases for filing that accomplish this purpose, and we have found that such a classification is absolutely necessary for our work of finding The One Best Way to Do Work, standardizing the trades, and making and enforcing standing orders for best management.

It is hoped that teachers of industrial engineering in our colleges will learn that *one* demonstration of building up The One Best Way to Do Work from the ultimate elements, in any kind of activity, will do more to teach a student the principles of motion study and most efficient methods of management than dozens of lessons dealing with generalities.

The coming generation should be taught a definite filing system for data of scientific management, laid out under a complete classification of all work; should be taught the method of selecting the right units to measure and the methods of measuring these units; and should be furnished with the devices for making the cost of measuring cheap, and with a method for synthesizing the resulting information. This would result in a general progress in world efficiency and an increase in quality of living that would mark an epoch in the history of industry and civilization.

Use of Fundamental Elements

The literature of scientific management abounds with examples of units of work improperly called "elements," which are in no sense elements. A classification for finding The One Best Way to Do Work, must deal with *true elements*, not merely with subdivisions that are arbitrarily called "elements".

Index Number
658.5423 Motion study

There has recently appeared a well-written biography of a great engineer [1] in which subdivisions of operations, requiring in many instances more than 30 seconds to perform, have been erroneously described as "elements". That error will again mislead many people. These so-called "elements" should be taken for what they really are, namely, subdivisions and not elements, and not confused with true elements, or fundamental units which cannot be further subdivided.

Scope of the Classification

This classification for finding The One Best Way to Do Work is applicable to all kinds of work. It was used by one of the authors while serving as ranking officer in the field under the training committee of the General Staff, standardizing the methods of The One Best Way to Do Work for teaching the five million men and officers in the World War. It has also been used in analyzing the work of the surgeon, nurse, hospital management, large department stores, selling, a great many kinds of manufacturing, accounting, office work in general, and many other kinds of work.

True Elements of Work

The classification of all work of any and all organizations for the purpose of finding The One Best Way to Do Work may be visualized as follows:

I. A complete organization, which consists of
II. Processes, such as

- (*a*) Financing
- (*b*) Advertising
- (*c*) Marketing
- (*d*) Distributing
- (*e*) Selling
- (*f*) Accounting
- (*g*) Purchasing
- (*h*) Manufacturing
- (*i*) Planning
- (*j*) Teaching
- (*k*) Charting
- (*l*) Maintaining
- (*m*) Filing

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[1] See "Frederick W. Taylor," by F. B. Copley.

These processes consist of

III. Operations, which consist of
IV. Cycles of motions, which consist of
V. Subdivisions, or events, or therbligs[2] of a cycle of motions which consist of

- (*a*) Search
- (*b*) Find
- (*c*) Select
- (*d*) Grasp
- (*e*) Transport loaded
- (*f*) Position
- (*g*) Assemble
- (*h*) Use
- (*i*) Disassemble
- (*j*) Inspect
- (*k*) Pre-position for next operation
- (*l*) Release load
- (*m*) Transport empty
- (*n*) Rest for overcoming fatigue
- (*o*) Other periods of unavoidable delay
- (*p*) Avoidable delay
- (*q*) Plan

VI. Variables of motions

- (*a*) Variables of the worker
  1. Anatomy
  2. Brawn
  3. Contentment
  4. Creed
  5. Earning power
  6. Experience
  7. Fatigue
  8. Habits
  9. Health
  10. Mode of living
  11. Nutrition
  12. Size
  13. Skill
  14. Temperament
  15. Training
- (*b*) Variables of the surroundings, equipment, and tools
  1. Appliances
  2. Clothes
  3. Colors
  4. Entertainment, music, reading, etc.
  5. Heating, cooling, ventilating
  6. Lighting
  7. Quality of material
  8. Reward and punishment
  9. Size of unit moved
  10. Special fatigue-eliminating devices
  11. Surroundings
  12. Tools
  13. Union rules
  14. Temperament
- (*c*) Variables of the motion
  1. Acceleration
  2. Automaticity
  3. Combination with other motions and sequence
  4. Cost
  5. Direction
  6. Effectiveness
  7. Foot-pounds of work accomplished
  8. Inertia and momentum overcome
  9. Length
  10. Necessity
  11. Path
  12. "Play for position"
  13. Speed

Under I, a complete organization, are included all kinds of organizations, including financial, industrial, commercial, professional, educational, and social.

Under II, processes, it should be noted that all processes are divided in the same way from a motion-study analyst's standpoint, regardless in which department or in which function they are found.

Under III, operations, the operations include mechanical as well as physiological, and mental as well as manual.

The reasons for these inclusions are:

1. From the motion-study standpoint there are not always clear dividing lines between the *operations of devices* and the *mental and manual operations of the human being,* for they are often mutually interchangeable, sometimes in part and sometimes as a whole.[3]

2. Records of many and probably all mental operations can now be obtained by the chronocyclegraph and micromotion photographic methods, and each year such photographic records can more and more be deciphered and used to practical advantage. Enough can already be read and used to serve our present needs. Careful examination of all our old micromotion and chronocyclegraph films taken under conditions of actual practice show that they are literally full of examples of such records of mental processes.

Under IV, cycles of motions are arbitrary subdivisions of operations. They have distinct and natural boundaries of beginning and ending. Usually and preferably there are certain sequences of therbligs that are especially suitable for standardization and transference to other kinds of work, and serve every purpose of finding The One Best Way to Do Work.

Under V, therbligs, we would emphasize that we do not place "motions" as the next subdivision under "cycle of motions" because "motions" have neither distinct and definite boundaries nor beginnings and endings. For example: It is difficult to determine correctly how many "motions" are required to take a fountain pen from the pocket and prepare to write with it. It will be found difficult to agree on just how many "motions" are made and as to where are located the boundaries of the "motions" of so simple a cycle as this, or of any other similarly common cycle of motions.

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[2] This word was coined for the purpose of having a short word which will save the motions necessary to write such long descriptions as "The 17 categories into which the motion-study elementary subdivisions of a cycle of motions fall."

[3] In 1910 and the years following, we collected and specially devised in our own laboratory, many devices for supplying, mechanically, the therbligs of cycles of motions that the crippled soldiers could not perform, due to their injuries. Such collections should be made by all museums and colleges that intend to teach motion study.

However, the 17 subdivisions, or events, or therbligs, as they are variously called, seem to be all that are necessary from which to synthesize all of the *cycles of motions* of all the *operations* of all the *processes* of all the *organizations* of every kind whatever. The science of motion study consists, therefore, of finding The One Best Sequence of therbligs for each kind of work and the science of management consists of deriving, installing, and enforcing the conditions that will permit the work to be done repeatedly in The One Best Way. It is conceivable that sometime in the future an eighteenth and possibly more therbligs will be found, and we seem near to their discovery at the present time. The discovery of additional therbligs pertaining to the phenomena of skill and automaticity seems inevitable.[4]

Under VI, variables of motions, provision is made for filing all information regarding any kind of motion made by either hand, device, or machine. It provides for all information regarding the structures in which work is performed. It provides for filing all data regarding human behavior—super-normal, normal, and sub-normal. It supplies the basis of filing all data of the educator, psychologist, psychiatrist, and the expert in personnel, placement, and promotion problems.

This classification can be carried on and subdivided indefinitely. It furnishes an efficient and quickly usable plan for synthesizing the components of The One Best Way to Do Work in such shape that they can be cumulatively improved.

However, our present information regarding the 17 therbligs is sufficient to revolutionize all kinds of work, and if the industries of the various nations would eliminate the obviously unnecessary therbligs and standardize the kinds, sequences, and combinations of the remaining efficient therbligs, the resulting savings each year would be sufficient to pay the outstanding debts of most nations.

History of This Classification

For many years we have used these therbligs as divisions for dissecting cycles of motions of a great many different kinds of work, but it was not until we began to use photography in motion study in 1892 that we made our greatest progress. It was not until 1912, when we used our first micromotion processes intensively, that we were able to make such great advances as projecting the motions of experts faster and slower, as well as at the speed of experts' demonstration. We were then also able to project and examine therbligs backwards, or in the reversed directions. This enabled us to get a new fund of information that resulted in many suggestions from seeing, measuring, and comparing the therbligs performed in the reversed sequence and opposite directions. This was used to great advantage in finding the methods of least waste and especially in the process of taking machines apart and putting them together again in front of a motion-picture camera, and then running the film backward, showing the films of assembling as dissembling and vice versa.

Examples of Profitable Use

Running films of super-experts backwards, to see what we could get for automatically suggesting inventions, or as "thought detonators" when seeing the operation done thus, presented peculiarities and combinations of therbligs never seen before. This was, of course, supplemented by examining one picture, or frame, at a time which, with motion-study experts will always be the most efficient method for getting facts from the films. Great progress was made, for example, in *pre-positioning for next operation* (therblig *k*) parts and tools so that *grasp* (therblig *d*) was performed with quite the same motions and actions and performed within a time equal to that of *release load* (therblig *l*).

As an example of the importance of recognizing the therblig as the fundamental element, the result of that particular study in 1912 was that our organization enabled a client to have his machine assemblers put together 66 machines per day with less fatigue than they had previously accumulated while assembling 18 machines per day. Because this method was synthesized from fundamentally correct units, the same methods are still in use today in this same factory.[5]

This increase in output should not be considered as an exceptional case. On the contrary, it is quite typical. In fact we have a great many illustrations that we could give where the savings were much greater. For example: One large motion-study laboratory, as a result of this method of attack, synthesized and demonstrated new methods which averaged an output of five times as much product per man. This method used in assembling carburetors enabled messenger boys to do the work in one-tenth the time required by skilled mechanics.[6] It has been used on work of assembling pumps with still greater results.[7]

Therblig Sequences

It was early recognized that certain similar operations have similar sequences of therbligs. For example: The operations of feeding pieces into a drill press or into a punch press, time tickets into a time stamp, and paper into a printing press, have practically the same sequence of therbligs. A typical sequence of therbligs for one complete cycle of handling one piece on a drill press is *search, find, select, grasp, transport loaded, position, assemble, use, disassemble, inspect, transport loaded, pre-position for next operation, release load* and *transport empty*. This cycle of motions can and should be done with the following therbligs: *grasp, transport loaded, position, assemble, use, release load* and *transport empty*, which are half the number of therbligs of the usual method.

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[4] See Society of Industrial Engineers Bulletin, November 1923, pp. 6-7. "A Fourth Dimension for Recording Skill," by Frank B. Gilbreth and L. M. Gilbreth. The lateness in starting or finishing of a therblig performed by any one anatomical member as compared with the time of beginning or finishing of a therblig performed by another anatomical member is a most important unit for measuring skill and automaticity.

[5] See *Management Engineering*, February 1923, p. 87. "Ten Years of Scientific Management," by John G. Aldrich, M. E., and also his discussion of paper 1378 on page 1131, vol. 34, 1912, American Society of Mechanical Engineers Transactions.

[6] See Proceedings of the Institution of Automobile Engineers, (English). "The Fundamentals of Cost Reduction," by H. Kerr Thomas, Member of the Council.

[7] See Society of Industrial Engineers Transactions, vol. 2, 1920, "The One Best Way to Do Work," by Frank B. Gilbreth and L. M. Gilbreth.

While the former is the usual sequence of therbligs on a drill press, it is by no means the best one. There is The One Best Sequence of therbligs on each machine and each kind of work, and it should always be found, standardized, taught, and maintained.

Another Work Classification

Now let us look at another method of subdividing and classifying all work. There is another and better known type of division and classification for visualizing all activity which was early recognized. The importance of considering this simple classification can be seen in the unfairness and trouble that have been caused by giving the same piece rate for large lots as for small. This classification divides all work, both large and small, into three parts, as follows:

1. Get ready.
2. Do it, or make it.
3. Clean up.

Now, applying this division to one piece on the drill press, we have:

1. *Get ready*, or pick up the piece and put it under the drill. This consists of all therbligs that come before *use* (therblig *h*).

2. *Drill it*, (do it or make it.) This consists of only one therblig, namely *use* (therblig *h*).

3. *Clean up*, or take the piece out from under the drill and inspect it and lay it down. This consists of all therbligs that come after *use* (therblig *h*).

The Importance of Use

It should be recognized that the therblig *use* is the difficult one to learn in mastering a trade. It is the most productive and, therefore, the most important therblig of all.

All other therbligs of all kinds of work are desirable and necessary only so far as they facilitate, prepare for, or assist in increasing *use*. Any therbligs that do not foster *use* should be under suspicion as being unnecessary. *Use* is the highest paid therblig, because it usually requires the most skill. The more of the therbligs of "get ready" and "clean up" that are performed by less skilled and consequently lower-priced workers the better for all workers, for they all will be employed a larger portion of the day at the highest-priced work at which they are each individually capable. This is true not only in the consideration of the therbligs but also in the trades in general. For example: The bricklayer, the plumber, the steam-fitter, the office executive, and many others, each have their specially assigned helpers, but they still habitually do much pay-reducing work for which in the long run they suffer a loss due to less personal activity. It will help to analyze and classify all work if it is recognized that the hod-carrier bears the same relation to the bricklayer, and the secretary to the executive, as do the therbligs that compose "get ready" bear to the therblig *use*; and the laborer's work of "clean up" after the work of the bricklayer, is quite the same as the therbligs that compose "clean up" after therblig *use*.

Further investigations of a typical sequence of therbligs, such as on the drill press or other examples cited, from the standpoint of the classification of the therbligs show that *grasp* (therblig *d*) of "get ready" is used before *use* (therblig *h*) and that *release load* (therblig *l*) done after *use* may be quite the same except that it is performed in motions that are the reverse of those of *grasp*.

Paired Therbligs

There are a number of such paired therbligs which are almost always separated by the therblig *use*.

For example:

PAIRED THERBLIG USUALLY PERFORMED BEFORE USE		PAIRED THERBLIG USUALLY PERFORMED AFTER USE
d. Grasp	Use....	*l*. Release load
e. Transport loaded....	Use....	*m*. Transport empty
f. Position	Use....	*k*. Pre-position for next operation
g. Assemble	Use....	*i*. Disassemble
q. Plan	Use....	*j*. Inspect

It was the absence of a therblig on the other side of *use* to pair with *inspect*, together with the fact that *plan* is actually found in the photographic records regardless of how much planning may be done prior to the beginning of an operation, that caused us to add to the list of therbligs, *plan* (therblig *q*). The therblig *plan* may occur in any place in the sequence of therbligs, but we have put it last in the list before cited because it was added last, and also to distinguish it from the "planning" that should be done before any "performing" of the operation is begun.

There are two more kinds of divisions, or orders, making a total of five orders of therbligs, namely, one consisting of *search, find* and *select*, (therbligs *a*, *b*, and *c*) which usually come before *use*, and *rest for overcoming fatigue, other forms of unavoidable delay* and *avoidable delay*, (therbligs *n*, *o*, and *p*) which usually come after *use*. Thus we have two orders of unpaired therbligs separated by *use*, as follows:

UNPAIRED THERBLIGS

ORDER NO. 4		ORDER NO. 5
a. Search ..	Use.	*n*. Rest for overcoming fatigue
b. Find	Use.	*o*. Other forms of unavoidable delay
c. Select ...	Use.	*p*. Avoidable delay

In analyzing an operation of any kind a simultaneous motion cycle chart is prepared. The therbligs of motion are applied to this chart in studying it for present methods and determining the altered sequence which should be adopted to establish The One Best Way to Do Work. This brought up the problem of graphic presentation of the therbligs for ready identification.

(To be concluded in the September issue.)

Handling 42,000,000 Tons of Raw Material a Year

Mechanical Conveying Methods in the Cement Industry

By L. N. DURYEA

Mechanical Engineer

No description, however brief it might be, depicting the manufacture of portland cement as it is now practiced in the United States, should fail to mention, in some way or other, the use of labor-saving equipment. There is, perhaps, no one basic industry, comparable to that of making portland cement, in which the keen competition of production has focused more attention on labor-saving devices and the development of that industrial art than in the manufacturing of this versatile building material.

It was not so many years ago that the making of portland cement, like so many other industries, was essentially a hand labor proposition. From the quarrying of the raw materials to the final sacking or barreling of the finished product, the human element was the dominating factor. Quite naturally, this industry—involving a product of great bulk as compared with the majority of manufactured products—was one of the first to realize the necessity of economical material handling throughout the various stages of manufacture. So thorough has been the conversion from the antiquated methods of hand labor to mechanical equipment that no human hand need come in contact with the material at any stage from the firing of the blast in the limestone quarry until the sacked cement is piled in truck, freight car, or boat.

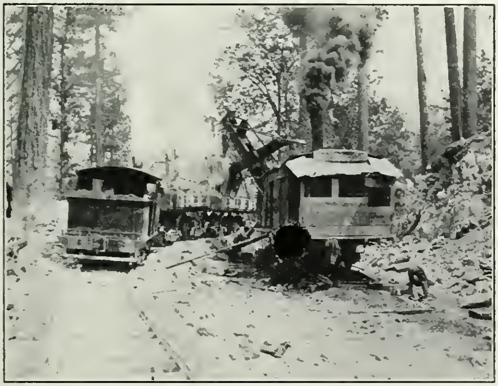

Fig. 1 Steam Shovel Loading Limestone Into Dump Cars

Back of that simple statement regarding mechanical equipment is a host of problems that involve almost every known variety of handling materials. Twice during its manufacture the material is in the form of an impalpable powder—finer than flour. At one stage it is in the form of a white-hot clinker. And to prepare the raw materials for burning into that clinker requires a succession of reductions from the solid rock of the quarry to a powder so fine that about 80 per cent will sift through a mesh of 40,000 openings to the square inch.

Index Number
666.9006:68 Cement plant.
Management
658.281 Mechanical handling

The problem of conveying is more highly developed and more extensively applied in the cement industry, no doubt, than in any comparable manufacturing enterprise. In producing the 137,377,000 barrels of portland cement turned out by the 127 operating plants in the United States last year, it is estimated that over 42,000,000 tons of raw materials were required. And this mass had to be transported not merely once but several times and usually over a considerable distance.

Even with the pick and shovel, wheelbarrow and scoop relegated to the scrap pile by the power shovel, mechanical conveyor, and automatic sacking machine, the labor cost of making cement is second only to fuel. The American cement industry, in improving production methods, has introduced the mechanical laborer wherever iron and steel or canvas and rubber could be made to replace human effort.

Peculiar Problems Involved in Making Cement

The fact that the price of cement on a weight basis is the lowest of any comparable manufactured material and that, in the average plant, the raw materials must be handled no less than a dozen different times before their complete conversion to portland cement, makes the problem of conveying one of the foremost in plant layout and administration. The efficiency of many of the machines, especially the burning kilns and grinding machines, requires a continuous and constant delivery of material.

Then, too, the very nature of portland cement introduces an interesting problem of material handling. While portland cement is sold to meet the standard specifications established by the United States government and the American Society for Testing Materials, whether it is manufactured in Maine or California, its constitution permits the use of various combinations of raw materials. And the proportion of these raw materials must be carefully controlled within close limits to provide the correct chemical elements in the right amounts.

To a large extent, it is the raw materials used by the particular plant that determine the manufacturing process, and that, naturally, has its influence on the selection of the type of conveying equipment.

There are two general processes of manufacturing portland cement, logically designated as the wet and the dry. This distinction concerns the preparation of the raw material previous to its burning into what is known in the language of the cement manufacturer as clinker. After the pulverized raw materials enter the rotary burning kiln, either in a dry or wet state, until the time the finished cement is packed for shipment, the process has become, to a large extent, standardized in this country, differing only in the mechanical details. In the wet process plant, the material is handled by pumps in the form of a slurry, and there it is more a problem of hydraulic engineering than one of mechanical conveying.

Bringing Raw Material from Quarry to Crusher

In producing the 25,800,000 tons of portland cement that were turned out last year the first step lay in getting that 42,000,000 tons of raw materials from the quarry or clay pit to the plant. By far the greater number of cement plants in this country use limestone as the major raw material, with clay or shale supplying the necessary admixtures to make the correct chemical combination.

The power shovel, in its many forms of operation, including steam, gasoline, compressed air, and electricity, has long been the universal means of loading the blasted rock, shale, or clay. (See Fig. 1). While steam is, and probably will be for some time to come, the dominating prime mover, there is a noticeable tendency, particularly in the smaller sizes, toward the purchase of gasoline-driven shovels. Electricity, especially for plants that are equipped with waste heat boilers, is finding its way into quarry and pit work for shovel operation.

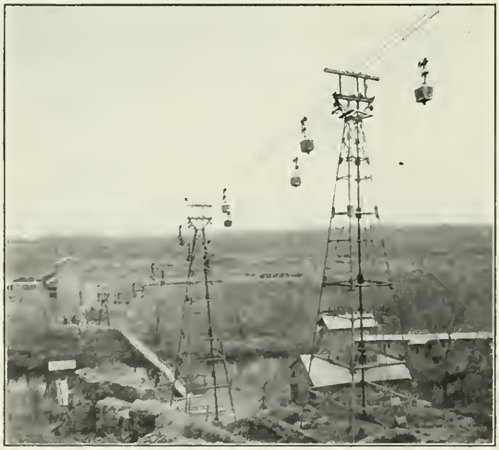

Fig. 2 Bringing Raw Materials from Quarry to Mill

But there are a few interesting variations from standard practice. In one mid-western cement plant that mines its limestone, compressed air shovels are in use, and down in Texas there is a plant that dredges sufficient oyster shells from the Gulf of Mexico to supply its lime requirements. Also, where the consistency of the raw materials will permit, such as for dredging some clays and marls, the clamshell and orange-peel buckets will be found.

The average annual plant consumption of raw materials in the plants of the United States is some 300,000 tons. With but few exceptions, the industrial railroad, either standard or narrow-gage, is employed to bring this amount to the plant. There are a few scattered instances where the cement plant has been located miles from its supply of raw materials, and then it is served by common carriers. But in the majority of cases the cement manufacturer controls his own transportation between plant and quarry.

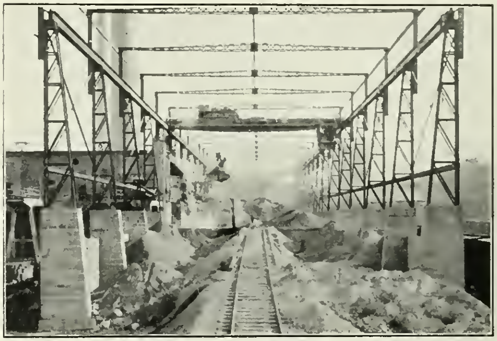

Fig. 3 Overhead Traveling Crane Handling Raw Materials

To haul the 1000 tons of raw materials that must be brought to the average plant every working day, the industrial railroad has taken many forms. As in the operation of the power shovel, steam is the usual motive power, although electricity and gasoline are frequently used. Where the haul is of any great length and the ground reasonably level, the standard gage is the rule, generally using dump cars that empty the raw materials directly into the primary crusher.

There are, however, many plants in which the problem is more complicated. Not infrequently, the materials must be lifted to a considerable height to start the first stage of manufacture. In that case, a hoist will operate a single car, or perhaps two cars will be balanced on a double track to help reduce the power cost of lifting.

But, as in most industries as widespread and complicated as cement-making, the problem of one plant is usually quite foreign to that of another. At one western plant, an inclined tramway is 4500 ft. long, lowers the material from a mountain top to a loading tipple some 1500 ft. below, where it is shipped to a nearby plant by railroad. An electric hoist returns the empty cars to the loading platform after they have been automatically dumped at the bottom of the incline. At the same mid-western plant that mines its limestone and loads it by compressed air shovels, the narrow-gage cars are hauled to a level slightly above the crusher platform by electric locomotives, and fed to a rotating car dumper by gravity.

But the industrial railroad is not the sole means of transporting the raw materials, for it meets some competition in the spectacular aerial tramway. (See Fig. 2). At certain plants, topographical features have made this means of conveying necessary. In one mill, where rough ground made a railroad impracticeable, a cableway a mile long is in use that lowers the material nearly 1000 ft. The gravity pull of the loaded buckets is sufficient to return the empty ones to the loading platform and at the same time is capable of generating considerable power.

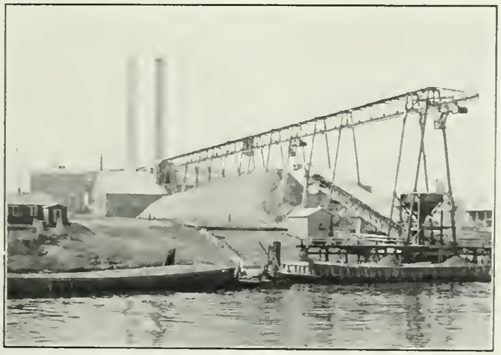

FIG. 4 CLAMSHELL BUCKET, OPERATED FROM MONORAIL MAN TROLLEY, HANDLES RAW MATERIALS FOR ONE TEXAS PLANT

Handling Material from Crusher to Kiln

The first step in the conversion of the raw materials into portland cement is the reduction of the rock, as it comes from the quarry, to pieces that will pass a 7 or 8 in. ring. And here for the first time we meet the mechanical conveyor in the true sense of the word. This process is usually followed by a secondary crushing where the materials undergo a further reduction to about a 2-in. maximum size. In those plants where two crushing processes are necessary, bucket-conveyors usually elevate the materials from the depository of the first to the feeding platform of the second. As these processes are largely intermittent, depending upon the supply from the quarry, and as the successive stages of manufacture require a continuous and steady flow of materials, it is usual to have the two stages stabilized by a raw materials storage.

After leaving the storage bins, the raw material must be properly proportioned, previous to passing through the grinding and pulverizing stages where it is reduced from sizes that will pass a 2 in. ring, to particles the size of sand, and finally to an impalpable dust. In some plants this grinding and pulverizing is accomplished in one machine, called a two-compartment mill, and there one handling of the material is eliminated. But in the majority of plants two separate stages are necessary, and the material coming from the battery of preliminary grinders must be collected and proportioned out to the final grinding or pulverizing machines.

It is in these stages of its manufacture—from the crushing to the rotary kiln—that we first find the many and varied kinds of conveying machinery. The pan, apron, and pivoted-bucket conveyors and elevators; locomotive, overhead-traveling and ore-bridge cranes; belts, and even screw-conveyors, all have a hand in moving the material in a steady constant flow throughout the individual plant.

In one of the newer Illinois plants, an economical and practical arrangement has been installed in linking the secondary crushers with the preliminary grinders. Under normal operation, a pivoted-bucket conveyor carries the freshly-ground stone from the crusher up and across the raw material storage bins to the preliminary grinding hoppers, the empty buckets returning in a concrete tunnel under the storage bins. Thus it is possible to supply the grinders from either the secondary crushers or the storage bins or to deposit the material in the storage bins in case the grinding department is shut down—completely divorcing the two stages.

Some plants, however, have found the clamshell bucket successful in handling the raw materials. In an Ohio plant put in operation not long ago, a clamshell, operated from an overhead traveling crane, distributes the raw material either into the storage bin from a dump near the secondary crusher, or feeds it directly into a hopper supplying the grinding machines. Fig. 3 shows a traveling crane with clamshell bucket in a large storage yard for raw material. In Fig. 4 is illustrated a monorail trolley handling a clamshell bucket to transport raw materials at a Texas plant.

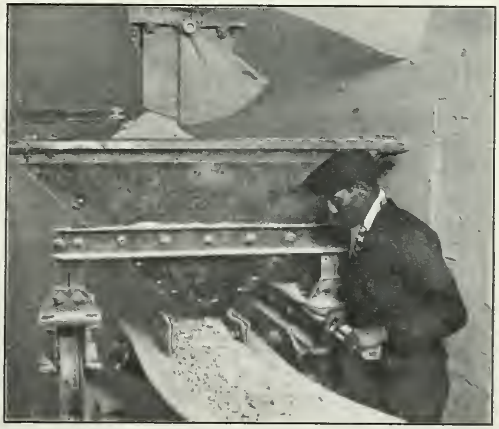

FIG. 5 BELT-CONVEYOR AND LOADER

In the entire manufacturing process, the belt-conveyor, no doubt, is the most widely used of all the various kinds. Its adaptability is, perhaps, its greatest asset, for with it material can be easily conveyed for considerable distances on the level or elevated on a slope as steep as 20 deg. (See Fig. 5).

Many types of pan, apron, and pivoted-bucket conveyors are in use for handling the material between the crusher and the kiln. Where material is to be drawn from a bin at constant rates, these types answer the purpose probably better than a belt-conveyor, as they eliminate a feeding device.

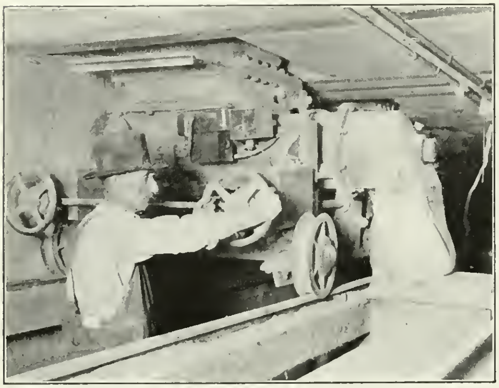

Fig. 6 Automatic Scales Weigh and Proportion the Raw Materials

To manufacture a product that will meet the rigid specifications adopted for portland cement by the United States government and the American Society for Testing Materials, the raw materials must be carefully proportioned as determined by previous chemical analyses.

Many plants keep a careful check on the different quantities of materials by means of a weightometer—a device that weighs and records the amount of material as it passes a certain point on a conveyor. Other plants have introduced electric scales that automatically weigh predetermined amounts of the raw materials before the combined material is started on its way to the rotary kiln.

An ingenious device can be seen in several plants, that provides for the compounding of the raw materials on a continuous and adjustable basis. This machine is known as a poidometer. A balanced roller in contact with a moving belt operates the feeding shutter of a hopper, increasing or decreasing the amount of feed depending on the quantity that passes the balanced roller. Fig. 6 shows an automatic scale used for proportioning materials.

From Rotary Kiln to Finished Product Storage

In the rotary kiln the raw materials undergo a chemical change, and an entirely different material is produced. This material—clinker—emerges from the kiln in a white hot condition in sizes about as large as marbles. In many plants this clinker passes into rotary coolers, although some mills carry it directly to an outdoor clinker storage pile where it is allowed to cool, as in Fig. 7. Clinker is impervious to the elements and hence this allows the cement manufacturer an opportunity to accumulate a reserve during the periods of slight demand, for use when demand increases.

Mechanical conveyors or clamshells are used almost entirely to reclaim the clinker from storage, although drag-line buckets have proved an economical and practical means in a few plants. An installation of the latter type is shown in Fig. 8. This clinker is taken to grinding, and later pulverizing mills, where it is reduced to the portland cement of commerce.

A southern plant has recently provided a clinker storage of some 100,000 barrels, served by an electric crane with a clamshell bucket of 4 cu. yd. capacity. A circular storage made possible by a clamshell hung on an 80 ft. boom at right angles to a 100 ft. mast, allows a western plant a clinker capacity of 140,000 barrels.

Coming from the pulverizing machines, the finished portland cement is handled almost universally by screw-conveyors. One of the greatest advantages of the screw-conveyor is its comparative elimination of dust in conveying finely ground material. The housing that so effectively confines the flying particles is an integral part of the screw-conveyor. It is that fact of preventing dust that has gained acceptance for the screw-conveyor in cement mills wherever the finely ground material is to be transported over a comparatively short level distance.

Probably the most representative size of screw-conveyor used in the cement industry is one with a diameter of 12 in. and a pitch of the same—meaning that in every foot of shaft length, the helix makes one complete turn. Fifty revolutions per min. is considered the desirable speed for a 12 in. conveyor, and operating at that speed 150 barrels, or a little over 600 cu. ft. of material, can be transported per hour. Standardized manufacturing has specified 12 ft. sections for 12 in. conveyors, requiring about three-quarters of a horsepower per section.

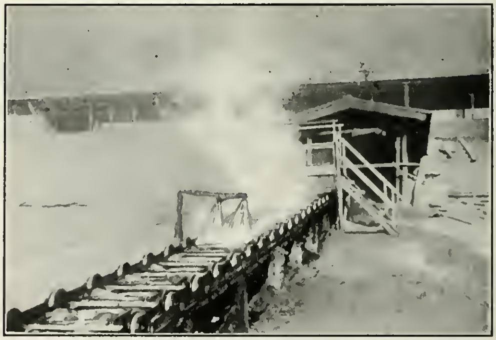

Fig. 7 A Shower Helps to Cool the White-hot Clinker as It Is Carried by a Pivoted Bucket Conveyor from Rotary Kiln to Clinker Storage

Two hundred ft. is considered a desirable maximum length for one screw-conveyor because of the excessive torque that is introduced on the shaft. Distances successfully used in other industries have been found impracticable for cement mills. There is, however, on record, as in successful operation in a cement plant, a screw-conveyor 325 ft. long. The screw-conveyor is limited to very nearly horizontal flow. Where screw-conveyors have been deemed advisable for long-distance conveying it is necessary to drop the level from 1 to 2 ft. at each successive conveyor.

Unloading the material from a screw-conveyor at any particular point is an easy matter. By simply providing a small opening in the bottom casing of the conveyor housing, the material will fall out. With a belt-conveyor, if changes are necessary in the unloading point, an automatic tripper is necessary.

The grinding of the clinker to finished portland cement frequently results in a temperature as high as 300 deg. fahr.—a problem that introduces some complications especially if the conveyor is subjected to winter weather exposure.

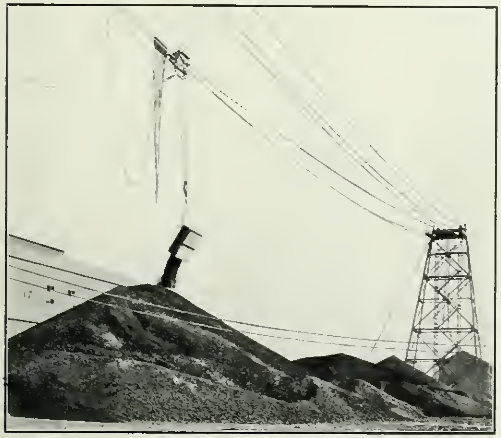

Fig. 8 Drag-line Bucket Handling Portland Cement Clinker

The solution of a conveying problem recently encountered in a cement plant in the Middle West may prove of interest. To an existing plant there was planned the addition of a second stockhouse at a distance of some 970 ft. The problem was satisfactorily to handle finished cement at times reaching a temperature as high as 300 deg. fahr., intermittently during all kinds of weather down to 20 deg. below zero.

The major considerations were the temperature differences, the distance to be covered, and the expense of the installation. The operating cost, as far as power was concerned, was of no great object inasmuch as all power required to operate the entire mill was generated in a waste heat boiler plant.

The problem was put before the consulting engineers who designed the plant, and it was finally decided that 12 in. screw-conveyors should be used throughout. Screw-conveyors were installed in four lengths. The first extended about 150 ft. from the cement elevator through the coal mills, and then three lengths were employed, two of about 250 ft. each and one about 325 ft. Two 40 hp. motors were required to propel the four sections of the conveyor, each motor pushing one section and pulling the other, through silent chain drives.

The conveyors were carried upon a steel gallery about 25 ft. high. This gallery was about 5 ft. wide, with plank floor and steel handrails. The driving and transfer towers were of the four-post type of common design with corrugated iron shelters for motors and driving gear. Fig. 10 shows a view of three sections of this conveyor system.

Sacking the Finished Cement

From the storage bins, the finished product is bagged for shipment by automatic bagging machines. (See Fig. 9.) These automatic bagging machines are, perhaps, the most important labor-saving devices—with the exception of the general system of conveying—that have been introduced into the manufacture of portland cement. Whereas it formerly took a gang of four men working 10 hr. to fill 1600 sacks, now one man can fill as many as 500 sacks every working hour. The empty sacks are tied by machines and are then filled through a flap valve in the bottom. The bagging machines are so adjusted that each bag will contain 94 lb. of cement.

The filled bags drop to a belt-conveyor where they are taken to loading stands, and here is where hand labor makes its first appearance in the manufacture of cement. Even here, some plants have found ways to sidestep the issue, as shown in Fig. 11. But as a rule, most plants use a two-wheel truck for loading the bagged cement into vehicles for shipment.

Auxiliary Labor-Saving Devices

But the use of labor-saving devices in the cement industry is by no means limited strictly to the manufacturing process. In an industry using such heavy machinery as a cement mill, the wear and tear necessitate frequent repairs and overhauling. The machine and repair shops are a most important adjunct to the cement plant and they must be well equipped with mechanical apparatus to handle the heavy loads imposed.

In the power plant, too, overhead cranes play a

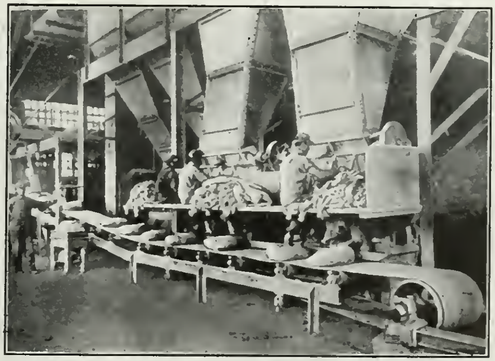

Fig. 9 Belt-Conveyors Carry the Bagged Portland Cement from the Automatic Sacking Machine to the Loading Platform

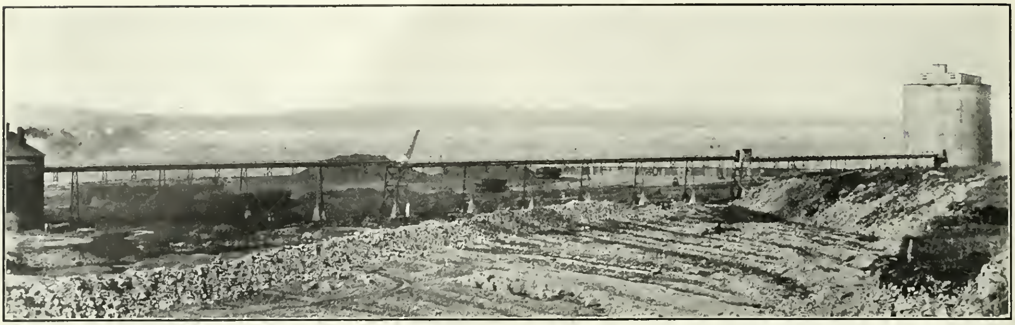

FIG. 10 SCREW CONVEYORS TRANSPORT THE FINISHED CEMENT FROM MILL TO STORAGE BINS

Three sections of the conveyor are shown. Near the right is the housing for one of the electric motors that drives the two adjoining sections. Total length of this conveyor is 970 ft., the longest of the four sections is 325 ft.

most important part in reducing delays when repairs are necessary.

To handle the repairs between the mill and the shop frequently involves considerable heavy trucking. A few plants have drawn on the experiences of other industries and have introduced the industrial truck or tractor for this purpose as well as for a host of other inter-plant jobs. Concrete driveways play an important part in cutting down costs for this type of transportation.

But in spite of the concentrated efforts that have been centered on labor-saving devices in the cement industry, labor is a most important item. To maintain in operating condition the vast array of machinery, one out of every five men employed in a cement mill is a member of the repair gang. As much as a tenth of the invested capital of some mills is tied up in repair parts, to reduce, as much as possible, the loss of productive time due to breakdowns.

While, unquestionably, the introduction of the rotary kiln was the most important contributing factor to the cement industry in this country, the very character of an industry that requires the handling of such vast quantities of relatively low-priced material, necessitates an elaborate and practical means of handling this material with a minimum labor charge.

There is no way of estimating, accurately, how much the growth of the portland cement manufacturing industry has been influenced by the great improvements that have been made in the materials handling equipment during recent years. Increasing demand for cement for use in road work, building construction, and other fields could hardly have been met under the old hand-labor methods. Even if it had been possible to manufacture enough cement to supply the demand, its cost under the old methods would have been so high as to place a decided brake on further expansion of the industry.

Because equipment manufacturers and engineers have made mechanical handling devices available to cement manufacturers they have been able to reduce their costs and increase their production far beyond the limits possible when a wheelbarrow was the only material handling equipment used.

Labor cost is still one of the largest items in cement manufacturing, but if hand labor were used to move the quantities of material now handled by mechanical equipment its cost would be practically prohibitive. In addition to this the use of material handling equipment has made possible more uniform operation of cement plants. Conveyors can be designed to meet certain capacity requirements and, when they are installed, can be depended upon to meet those requirements every hour of the working day. Because of this, a uniform rate of production can be maintained, eliminating, to a large extent, idle machinery and men with all the added costs and decreased production that accompany them. It is evident, then, that the rapid growth of the material handling equipment industry has greatly influenced portland cement manufacturing operations.

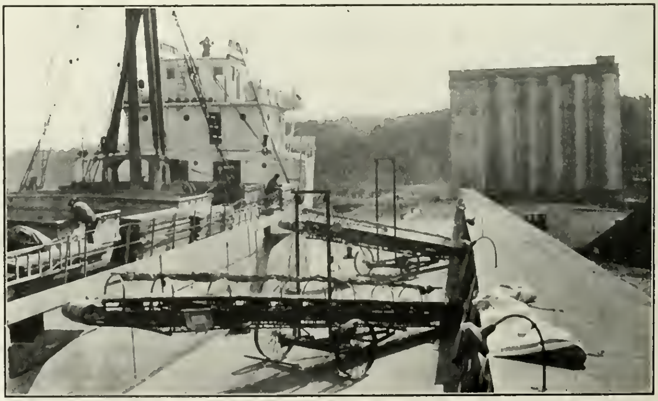

FIG. 11 A BELT-CONVEYOR BRINGS THE BAGGED PORTLAND CEMENT TO PORTABLE ELECTRIC CONVEYORS THAT CARRY IT DIRECTLY TO CHUTES INTO THE HOLD OF THE SHIP. FOR TRANSPORTATION BY RAILROAD SOME PLANTS EMPLOY MECHANICAL FREIGHT CAR LOADERS TO CARRY THE BAGGED CEMENT FROM STORAGE WAREHOUSE TO CAR.

Graphic Control in a Small Hosiery Mill

A System Capable of Assisting in Paying Dividends

By W. E. HASELTINE

Vice-President, Ripon Knitting Works

EVERY industry has its own particular methods of accounting, systematizing, departmentizing, and control. Through them all certain principles prevail and general methods may be applied. Among the latter are graphic systems for visualizing facts to show just where the enterprise is at a given time and whither it is headed.

From this point of view I will outline how charts are employed in a small hosiery mill to give control of all the factors entering into operation. The particular methods may be applicable elsewhere in the same industry, or after modification may be adaptable in other industries.

The charts used in our hosiery business are divided into three general classes:

1. Those Giving a General Picture of the Status and Progress of the Business

These cover
- Orders and shipments
- Sales and expenses
- Current assets and liabilities

2. Manufacturing Control and Cost Checking Charts

Under this head come
- Capacity and output charts
- Monthly and daily output records
- Progress on individual numbers
- Stocks of working materials
- Materials consumed
- Labor costs
- Manufacturing overhead
- Inventories of raw materials
- Inventories of finished goods
- Inventories of goods in process

3. Distribution and Administration

These include
- Selling expense
- Packing and shipping expense
- Administration expense

Taking these up in the order given, the upper section of the chart of Fig. 1 shows in black columns the shipments for each month of the present year, while the irregular dotted line gives shipments for the corresponding months of last year. The lower section indicates total shipments to date compared with shipments for last year, while the upper curve gives total orders to date.

The difference between the curve of orders and that of shipments is, of course, the balance of unfilled orders.

By extending the 1923 shipment curve parallel to that of 1922 it is evident that if shipments for the last six months of 1923 are equal to the same period of 1922, present orders can hardly be filled by January 1, 1924. As these goods are for fall delivery, this means that shipments must be speeded up.

Index Number
658.53 Production charts
658.9:687.3 Hosiery mill management

The lower portion of the chart of Fig. 2 indicates total sales to date, cost of goods sold, and total expense. The upper portion of the chart gives profit and loss in percentage of net sales. The dotted line across the chart marks the percentage of profit on net sales for the preceding year. (Note that the upper curve is to be read on the scale of percentage, and not that of dollars).

It is at once evident that, in the case shown, operation has just crossed from the zone of deficit into that of profit, and that conditions are improving; that the cost of goods has been well below the sales price, and that the failure to make money in the early months of the year has been due to the load of administration and general expense spread over a comparatively small amount of business. Also it would appear that a distinct improvement can be looked forward to as the months of heavy shipments are reached.

Current Assets and Liabilities

Neither fixed assets, such as Plant Investment, nor the liabilities represented by Capital Stock, Bond Issues, etc., are charted, as these are not subject to great nor sudden fluctuations.

The charts of Figs. 3, 4, and 5 cover the current assets, and those of Figs. 6, 7 and 8 the current liabilities. They are arranged as shown for convenience of comparison.

The comparisons with the year before, which are shown on these, as well as many of the other charts, are particularly illuminating.

On the inventory chart, Fig. 4, note the curve showing insurance carried. This comparison greatly aids in keeping insurance coverage at the proper figure.

A total current assets chart and a total current liabilities chart are also used and are distinctly useful, but as they are simply the summaries of the charts given, they are not reproduced here.

Manufacturing Control and Cost Checking Charts

Capacity and output. In planning operation it is of primary importance to keep track of how far plant capacity is being sold up, as well as how actual output is progressing as compared with theoretical capacity. These factors are essential for scheduling work.

Disregarding individual numbers for the present, plant capacity is divided into certain general classes such as:

160 Needle Hosiery
84 Needle Hosiery
68 Needle Hosiery, etc.

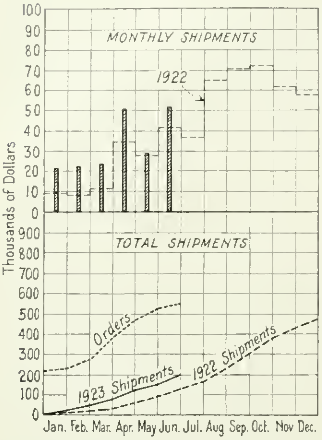

FIG. 1 ORDERS AND SHIPMENTS

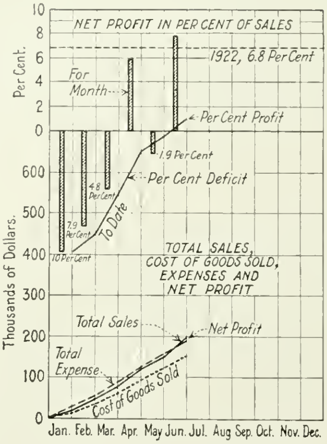

FIG. 2 SALES, COSTS AND PROFIT

These classes are not interchangeable. For example, a certain amount of equipment is adapted to producing 160 needle hosiery in various stock numbers, but this capacity is not suitable for the production of 84 needle hosiery, nor vice versa.

A chart is prepared for each of these classes, similar to the chart of Fig. 9 which covers 84 needle hosiery. Upon these are plotted as reference lines the normal capacity of the particular group of machines, and the maximum capacity of the same equipment operated at the best practicable efficiency.

These are straight lines starting at zero and ending at estimated output for the year upon both the above bases.

Upon these charts are plotted periodically the actual output of the classes in question. These lines will show how efficiently each group of machines is operating, and enable the plant manager to prophesy his output. After each plotting the balance yet to be knitted in each class is added to the quantity already knitted, and a tack or pin placed where an extension of the "knitted" line crosses the vertical scale indicating the amount in question. This shows at once just when, at the present rate of output, the orders on hand can be completed, and enables the manager to adjust his operation by speeding up, cutting down, or shifting operators as necessary.

On the chart shown this pin is marked "sales". If the present pace is kept up, orders will be knitted by about November tenth. If machines had been run at only normal capacity these orders could not have been filled until January.

Monthly and Daily Output Records. Monthly and daily graphic records of output are kept. The chart of Fig. 10 shows the monthly knitting record, the lower curve giving the total knitted to date in comparison with 1922, while the upper columns indicate the output for the individual months. The irregular dotted line gives for reference the amount knitted for the several months of the preceding year. The "orders" curve is also sometimes plotted on this chart.

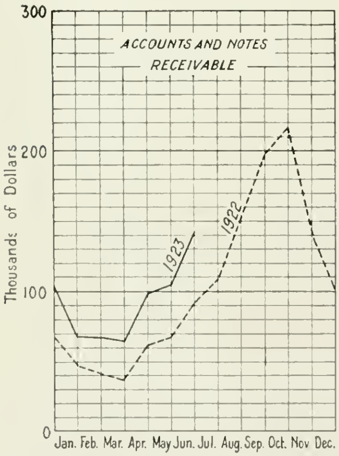

FIG. 3 ACCOUNTS AND NOTES RECEIVABLE

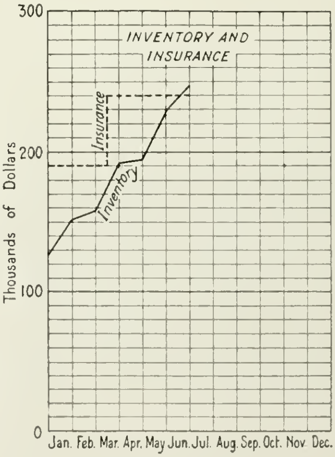

FIG. 4 INVENTORY AND INSURANCE

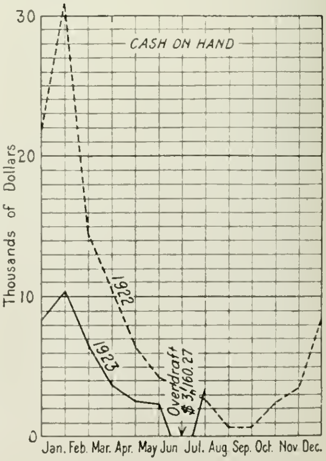

FIG. 5 CASH ON HAND

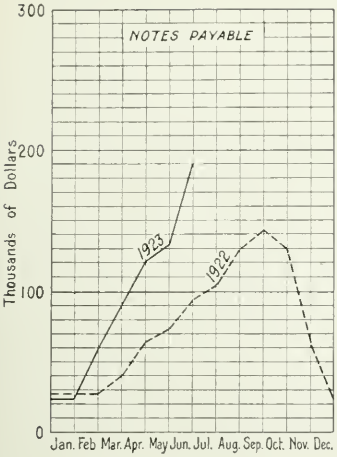

Fig. 6 Notes Payable

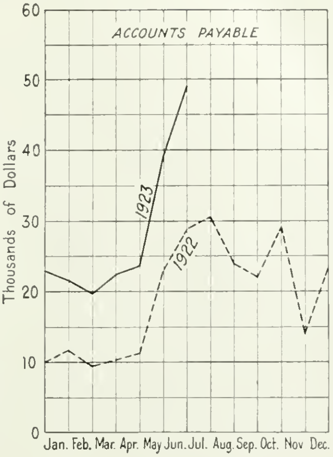

Fig. 7 Accounts Payable

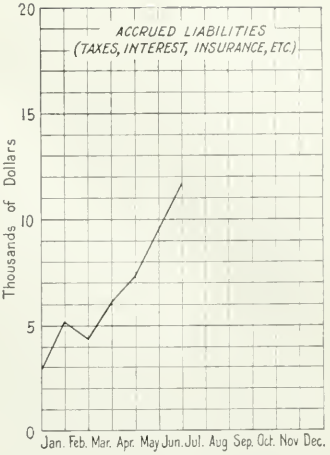

Fig. 8 Accrued Liabilities

The daily knitting record is not shown here, as it is precisely similar in character to the monthly record, except that, for the sake of simplicity, the reference lines for the year before are made straight.

For the lower portion of the chart this line is a diagonal starting at zero at the beginning of the month and ending at the output for the corresponding month of the year before. For the upper portion of the chart the reference line is drawn horizontally at the average daily output for the corresponding month of the preceding year.

There are also plotted in different colors upon the same chart curves for the amounts finished, boarded, packed, etc. These give immediate warning of goods piling up in any department. They are not shown here, however, as reproduction of them all in black and white would make the chart too confusing.

Progress on Individual Numbers. The foregoing charts show general conditions but do not give the necessary information about the individual numbers. These are so numerous that a separate chart for each would involve an immense amount of work. Therefore a chart similar to that of Fig. 11 is used.

At the left are listed the various stock numbers, and opposite these horizontal bars are drawn, indicating by their length the total to be knitted. These lines are extended periodically as additional orders are received. At the proper point along each line a colored pin is placed, indicating how many dozen of the number in question have been knitted to date. These pins are moved forward daily.

In the column at the left of the chart, headed "In Work" colored pins are placed, indicating the numbers which are being knitted. These also are corrected daily.

This is, perhaps, the most important chart of all from the mill operator's standpoint, as it shows him at a glance the exact progress made, and enables him to control his operation effectively. The moving of the pins requires but a few minutes each day.

Stocks of Working Materials. The best laid plan of operation is of no avail unless it is certain that materials will always be available to work with. The Yarn Stock, and Perpetual Inventory Chart of Fig. 12 shows how check is kept on this essential material. The various yarns used are listed at the left. Opposite each of these there is placed, at the proper position upon the scale, a green pin indicating the amount of this yarn on hand. Farther out, on the same horizontal line, is placed a brown pin, the space between these pins giving the balance on order.

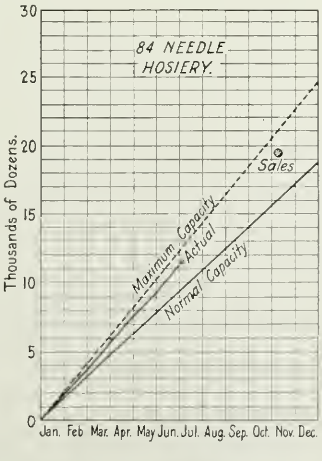

Fig. 9 Capacities of Machine Groups

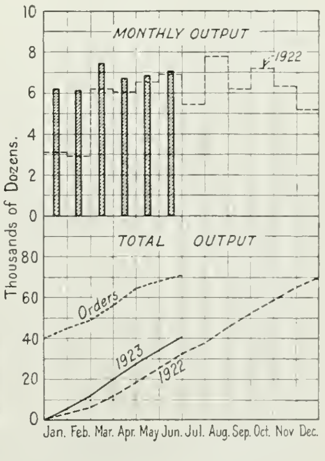

Fig. 10 Output Record

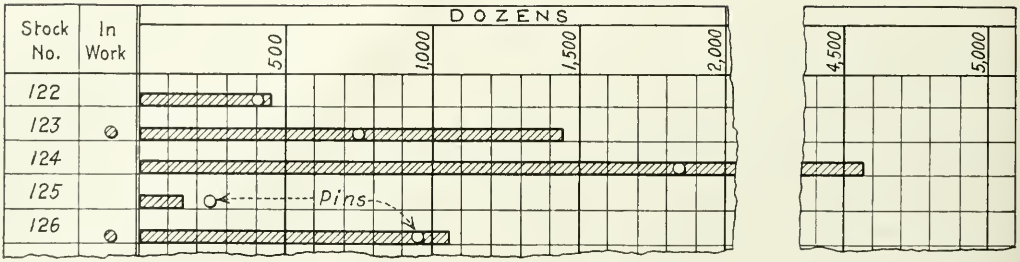

FIG. 11 PROGRESS OF WORK ON INDIVIDUAL NUMBERS
Length of bars shows total to be knitted. Pins show quantity knitted to date.

In the space to the right of the chart proper, labeled "Inventory," a small hook is placed opposite each yarn. As yarn is received and checked in, a small tag is made for each bale or case, giving bale number, lot number, weight, size, color, kind of yarn, price, etc. These tags are hung upon the correct hooks, the green pins at the same time being advanced to the proper points.

As yarn is taken from stock to process, the tags representing the various bales are removed from the hooks, entered in the yarn consumption record, and both the green pins and the brown are moved a corresponding distance to the left. If only a portion of a bale or case is put into process, this amount only is entered in the consumption record, and the tag is left on the hook, but the weight corrected thereon to the amount left in stock.

Should it be desired to place yarn back from process to stock, an arbitrary bale number is given it, and a tag made and hung upon the proper hook in precisely the same manner as in receiving yarn from the mill. These changes are made each day, so there is continually before the factory superintendent a picture of his stocks on hand and on order, as well as detailed information regarding each bale in stock.

In actual practice pins of other colors are used to show yarns in transit as well as the requirements on each kind of yarn, but for the sake of simplicity it seems best not to show them here.

The entire space required for a chart of this kind, covering 100 kinds of yarn, is but 2 ft. by 2 ft. 6 in.

Cost Checking Charts. The principal subdivisions of expense used in calculating hosiery cost for the plant in question are: (1) Materials; (2) Labor; (3) Manufacturing Overhead.

Materials. The chief material in the manufacture of hosiery is yarn. The theoretical and actual consumption of each kind of yarn is computed and tabulated monthly, but in actual practice only the total yarn consumption is followed graphically. This is shown on the chart of Fig. 13.

Upon the lower portion of this sheet are plotted the net and gross calculated weights of goods manufactured (i. e., the finished weight of goods, and this weight plus the allowable percentage of waste), the actual yarn consumption, and the waste recovered.

The curve of yarn used should, if the operation is correct, fall between the calculated net and gross, while the waste recovered should theoretically equal the difference between the calculated net, and the actual consumption.

To bring out these relations more clearly, the upper portion of the chart shows the per cent of net calculated; also the waste recovered upon the same scale.

It will be noted in the case presented that the total actual consumption to date was 7.3 per cent above calculated net, whereas the allowance made in figuring costs was 10 per cent. The operation is, therefore, satisfactory. Further, the waste recovered amounts to 7.8 per cent of calculated consumption or a trifle more than the excess shown above. This indicates that the hosiery weights are running within one-half of

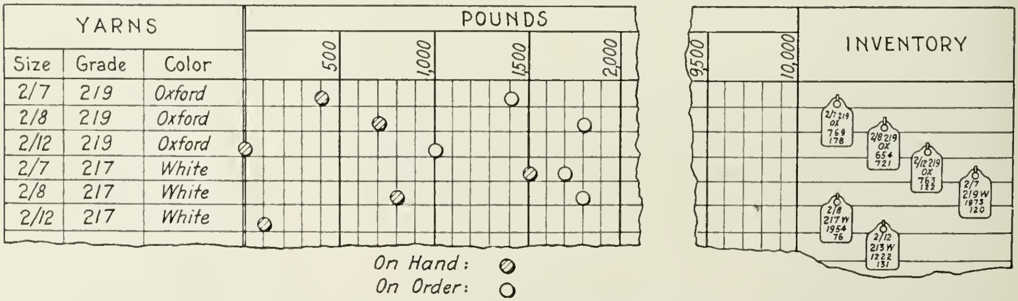

FIG. 12 YARN STOCK AND PERPETUAL INVENTORY CARD
Stocks are shown by a green (shaded) pin, requirements by a brown (unshaded) pin. Tags on hooks in inventory column show bales of materials received and accounted for by the green pins.

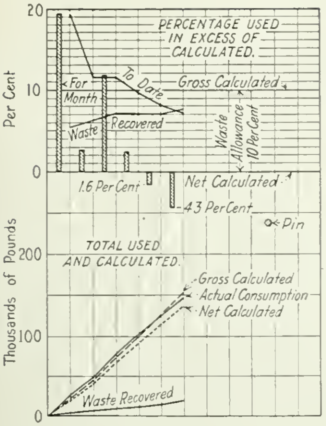

FIG. 13 CONSUMPTION OF YARN

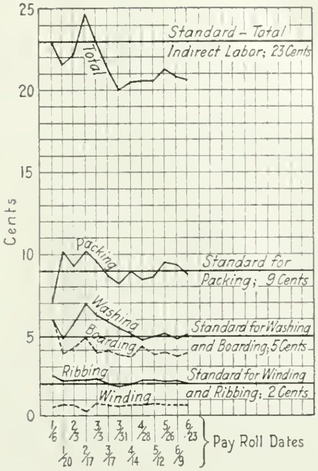

FIG. 14 INDIRECT LABOR COSTS

one per cent of correct, which is quite satisfactory.

From the total consumption curve it is evident that 149,000 lb. of yarn has been used from January 1 to July 1. Assuming that there was on that date 90,000 lb. in stock and on order, this amount plus that consumed would equal 239,000 lb. A tack or pin is placed at the point where an extension of the consumption curve would cross the 239,000 lb. line, and it is evident that the plant is covered on enough yarn to run it until after the middle of October. This assumes that the yarns in stock and on order are usable and properly balanced, and is intended only as a rough estimate.

Consumption records of other materials are kept, and are checked monthly against the standards used in calculating the costs, but these are of such minor importance that they are not followed graphically.

Labor. Operations which are paid for upon a straight piece-work basis, and which go into our cost sheets at the piece-work rates, are not charted for obvious reasons. All operations which are paid for upon any other basis, however, are followed on a Unit Labor Cost Chart.

We will assume that the allowances per dozen for these operations, as carried into our cost sheets, are as follows: (1) winding—2 cents; (2) ribbing—2 cents; (3) washing—5 cents; (4) boarding—5 cents; (5) packing—9 cents; total, 23 cents.

These costs are followed through on the chart of Fig. 14, where the curves are plotted for each pay-roll period by dividing the total paid for each operation by the number of dozens passing through the operation. As long as the total stays below the standard 23 cents line, costs are on the safe side, but individual curves show at once where attention is desirable.

Other manufacturing expenses, such as washing materials, which go into the cost sheets at so much per pound of goods washed, are handled in a similar manner.

Manufacturing Overhead. Manufacturing overhead is included in the costs as a percentage of the direct labor charge.

The chart of Fig. 15 shows total Manufacturing Overhead to date compared with the previous year, as well as this expense in percentage of direct labor cost. This latter is, of course, the significant figure.

From this chart it will be noted that, whereas the manufacturing overhead expenses for the current year were considerably greater than for last year, yet the percentage is satisfactorily below the 40 per cent line which has been set, and also below the actual percentage

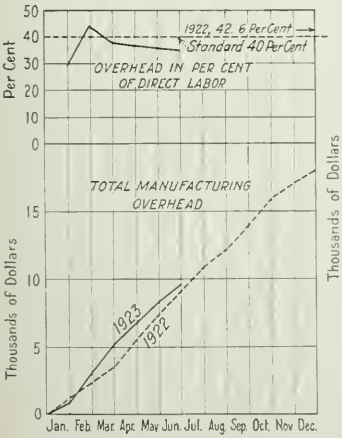

FIG. 15 TOTAL MANUFACTURING OVERHEAD IN COMPARISON WITH DIRECT LABOR

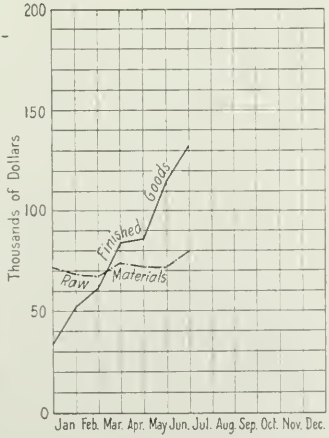

FIG. 16 VALUES OF RAW MATERIAL AND FINISHED GOODS ON HAND

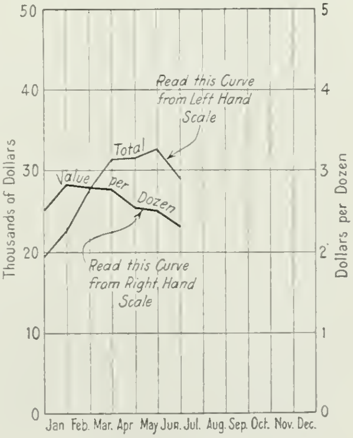

FIG. 17 VALUE OF GOODS IN PROCESS, TOTAL, AND PER DOZEN

of 42.6 per cent for 1922, as indicated on the margin of the chart.

This checking of overhead is one of the most important steps of all, as it is vital to know whether or not the industry is running right in this regard.

Under the head of status come the charts which follow the total values of Raw Materials in Stock, Finished Goods on Hand, and Goods in Process.

The chart of Fig. 16 covers the former two, while on the chart of Fig. 17 are plotted two curves of Goods in Process. Probably no curves are more significant than these latter as a check upon the calculated costs. In the plant in question the Goods in Process account is charged with all materials consumed, and all direct and indirect labor taken from the pay-rolls, and with factory overhead. Each month this account is credited with all goods delivered to stock at their calculated value taken from the cost sheets. The balance in this account consequently represents the book value of the goods in process.

This curve should run fairly uniform, provided the quantity and quality of goods in process do not vary greatly. In order to take care of the variation due to changes in the volume of goods, a curve is plotted representing the value per dozen.

If the cost figures are correct this should be an approximately horizontal line. If it rises it indicates either that the costs are calculated too low, or the goods in process are of a higher average quality than at the end of the preceding month. If it falls it indicates the opposite condition. A line which rises continuously month after month is an almost certain indication of too low cost figures, while one which consistently falls is indicative of a contrary condition.

The unit curve on the chart of Fig. 17 indicates that, in all probability, the costs in the present instance are figured somewhat too high. This is a confirmation of the conditions shown on the charts of Figs. 13, 14 and 15, where Materials, Labor and Overhead are all somewhat under the calculated standards.

The above covers the more important charts used in manufacturing control. The goods are now finished and in the warehouse. They have yet, however, to accumulate the expenses due to selling and distributing. The next step, therefore, is to check distribution and administrative expenses.

These expenses are included in the selling price of goods as an estimated percentage of such selling price.

The figures used for 1923 were: (1) selling expense —6 per cent; (2) packing expense—2 per cent; (3) administration—6½ per cent.

The lower sections of the charts of Figs. 18, 19, and 20 show the actual expenses as compared with 1922, while the upper sections analyze these figures in percentage of net sales. The relation of these upper curves to the standard percentage lines indicate how nearly correct are the estimates used.

The above system of control which has been in operation for some time has proved very satisfactory. It goes into considerably more detail than outlined herein. Two or three days' work at the beginning of each year, a half-day once a month, and a few minutes each day serve to keep the charts up to date. Mounting them on hinged frames fastened to the wall makes them readily available for reference and use.

Graphic control is particularly valuable to the higher executives of a concern who may be more interested in obtaining a general picture of operations than in studying a detailed report. As a general thing, when the company's operations are progressing smoothly, there is little need for a detailed study of the situation. Graphic charts provide a simple means of keeping in close touch with sales, production, and financial operations. By including in these charts information concerning what the business should be, any deviation from a satisfactory condition is at once brought to light. When such a condition occurs, usually it will be necessary and advisable to study it to some detail in order to arrive at proper conclusions regarding its source and the best way to change it.

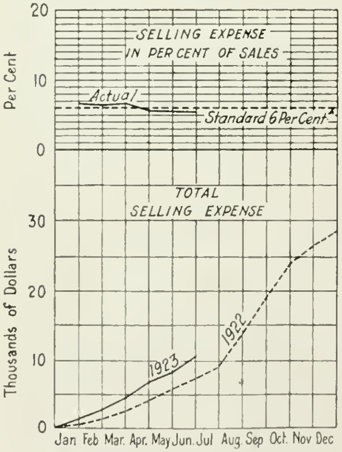

FIG. 18 SELLING EXPENSE, TOTAL, AND IN PER CENT OF SALES

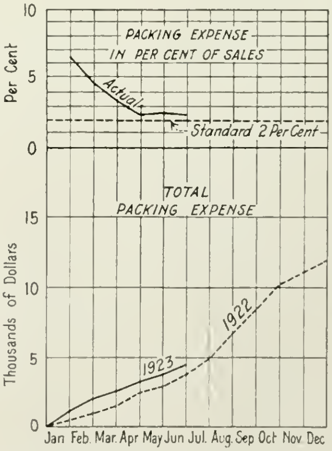

FIG. 19 PACKING EXPENSE, TOTAL, AND IN PER CENT OF SALES

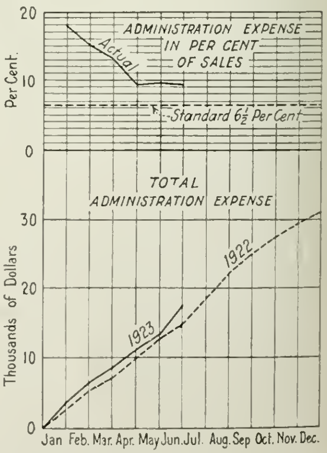

FIG. 20 ADMINISTRATION EXPENSE, TOTAL, AND IN PER CENT OF SALES

Textile Finishing Plants

The Piedmont Section of the Carolinas

By RALPH G. MACY
Consulting Mechanical and Electrical Engineer

THE facilities for bleaching and finishing the textiles manufactured in the Piedmont section are sufficient to care for but 40 per cent of the goods produced. However, this condition is rapidly changing with the addition of new finishing plants. One of the largest and most modern in equipment is the Southern Bleachery in Greenville, South Carolina. This plant is an exceptionally large one, Fig. 1, and is said to be one of the few equipped to handle fancy goods. A few years ago practically all textiles were sent to New England for finishing, and this meant an increase in cost due to the transportation expense.

The modern finishing plants are of one or two stories and are usually constructed of reinforced concrete with steel sash which permits a large glass area. In conformity with the cotton mills the people of this section construct their own mill villages, and the general conditions with regard to the personnel are the same as those which will be described in the article dealing with the labor situation.

The finishing process in general is as follows:

The material is first singed—if not sized—and is then washed in sulphuric acid. It is again washed and then boiled, with steam at 20 lb. pressure, which is approximately 260 deg. fahr., for some 12 hours in caustic solution. It is washed again and placed in a chlorine solution for 12 hours, after which it receives another washing. The next step is to immerse the material in a sulphuric acid solution and store it for 12 hours, after which it is washed and stored for several days. It is then put through a water mangle and starched and dried. The goods are next put in the tenter range and are brought into contact with the cylinder rolls and surfaced.

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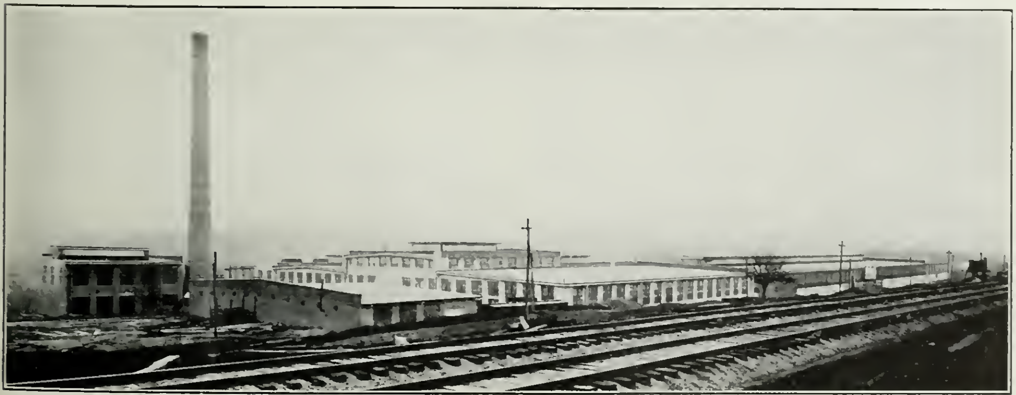
667.38 Textile finishing

In this finishing of the goods the range process is used and has been found to operate satisfactorily and efficiently. A general layout in one of the finishing plants and the arrangement of the apparatus where the range process is used is shown in Fig. 2. The equipment consists of a water mangle and a 20-cylinder dryer, a Tommy Dodd, and a 30-cylinder dryer, and a tenter range. The motors driving these machines are of the slip-ring type with external resistance as they are brought up to speed simultaneously, the starting torque being such that this external resistance is required so as not to draw an excessive amount of current from the line. After being brought up to speed, the variations that are required are obtained by the Lewellyn Variator. The variations in speed in the range process are due to the slow speed required while the cloth is being run, the different weights of cloth requiring a change in speed due to the variations in the number of yards per minute going through the process, and to take care of any inequalities in the goods.

The cloth is first fed to the water mangle, Fig. 3, which is driven by a 25 hp. motor, 1165 r.p.m., through a No. 15 Lewellyn Variator which is connected to the motor by chain drive. It then goes to the 20-cylinder dryer and folder. The speed of the cloth is controlled in the process by a dancer roll. The second step takes the cloth through the Tommy Dodd,



Courtesy of J. E. Sirrine & Co.

Fig. 1 The Southern Bleachery, Greenville, S. C.

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[1] Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION for May 1924, p. 517; June 1924, p. 663; July 1924, p. 47.

Fig. 4, where a paste or starch is added to the cloth and from which it goes to a 30-cylinder dryer—the speed of the cloth in this apparatus is controlled by hand. The Tommy Dodd and the dryer are driven by a 15 hp. motor, 1160 r.p.m., through a No. 14 Lewellyn Variator and this also is driven by a chain. The cloth then goes on the tenter range, Fig. 5, which is driven by the same type of motor and drive that is used on the Tommy Dodd and the 30-cylinder dryer. From this it passes through a cooling cylinder, an atomizer, and a winder. The speed in this process is also controlled by a dancer roll which operates as follows:

When the cloth stretches the dancer roll will drop, and through a Hatchway Limit Switch and a small motor will slow down the variator until the cloth becomes taut again. This raises the dancer roll, which in turn through the same switch and motor, speeds up the variator. As the cloth is varying continuously the Hatchway switches are kept in practically constant operation by the dancer roll. This assures that the correct amount of cloth is being fed continuously through the machine.

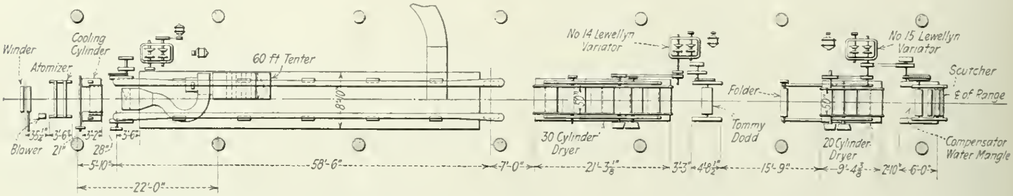


FIG. 2 LAYOUT OF FINISHING PLANT SHOWING ARRANGEMENT OF APPARATUS WHERE RANGE PROCESS IS USED

At the present time there are said to be experiments in progress to devise a system that will do away with Lewellyn variators and substitute brush shifting motors. This would give approximately 3 to 1 speed changes and in this way the required variations will be obtained. However, the present system appears to be giving excellent results, and will probably not be superseded by motors for some time to come.

Dyeing of Textiles

The dyeing of the textiles manufactured in this section is done locally, some plants having their own departments for this work; the printing, however, is done mostly in the north. With the increase in the number and size of finishing plants it appears to be a matter of relatively a short time before the textile mills of the Piedmont section are dyeing, bleaching, and finishing locally practically all of the goods they produce. The knitting mills of the Piedmont section are located in the vicinity of Winston-Salem, and have had a rapid and permanent growth that has meant much to the textile development of this section. In 1912 the value of the product for the state of North Carolina was $6,082,360, and in 1922, it had reached $27,352,354, an increase of 349 per cent in 10 years. Of the 141 mills in the state 91 are located in the Piedmont section and many more in adjacent counties. The number of people employed in the industry during this period increased from 6853 to 12,564. Many of the plants are modern in every detail. In Fig. 6 is an excellent example of a plant constructed of reinforced concrete with brick curtain walls and steel sash. It has a large glass area allowing plenty of daylight, and makes a fine appearance. Considerable attention is given to illumination, the operators of the knitting machines being assisted in their work by good lighting facilities. In one plant which is constructed of reinforced concrete the ceilings are painted a glazed white and the semi-indirect system of lighting is used. In this mill considerable attention is given to the health and recreation of the employees. The girls have a large and excellently equipped restroom, and a lunchroom in the building is operated at cost for the benefit of the employees. The management is familiar with the advantage to be derived from the application of scientific principles to the production of its products. The operation of this industry appears to be more modern than that of the cotton mills. The materials manufactured are knit goods, underwear, hosiery, etc., and are considered the equal of any in the United States.

In the northern part of the Piedmont section, in the vicinity of Winston-Salem, Dunham, and Greensboro,

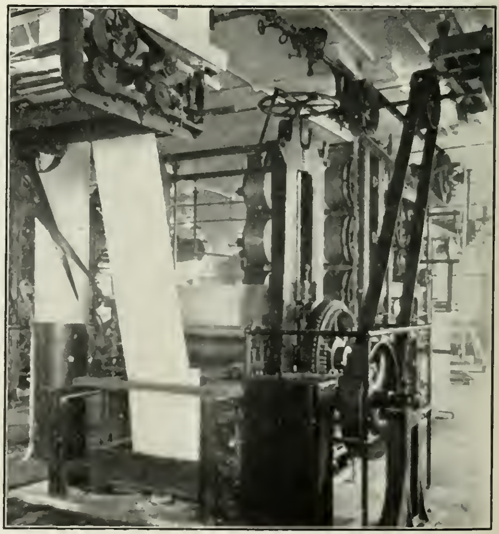
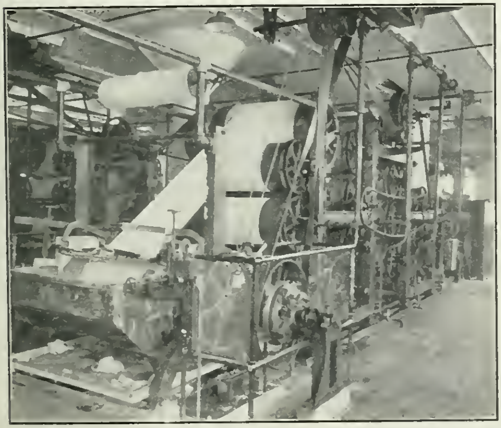

Courtesy of J. E. Sirrine & Co.

FIG. 3 WATER MANGLE AT WARE SHOALS BLEACHERY

are located the factories for the manufacturing of tobacco products. Some idea of the growth of this industry can be obtained when it is noted that in 1909 the value of the manufactured products was $35,987,000 and in 1922 this had increased to $214,830,348, an increase of 497 per cent in 10 years. These figures are certainly exceptional when compared with the growth in the value of the products throughout the United States, which approximates 220 per cent for the same period.

There were 16,449 workers employed in this industry in 1922, of which 9610 were men. During 1922 the state of North Carolina ranked second in the quantity of tobacco produced and in value. Its factories, all of which are located in, or adjacent to, the Piedmont section, required practically one-fourth of the tobacco crop of the entire country.

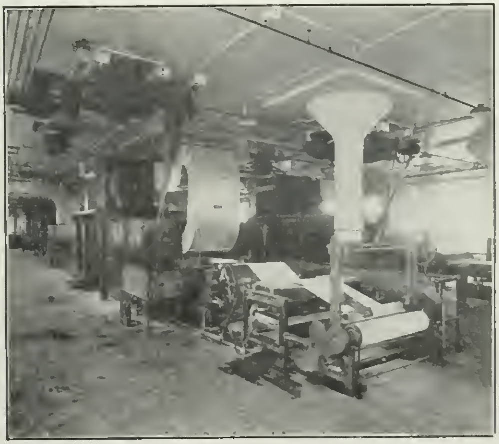


Courtesy of J. E. Sirrine & Co.

FIG. 4 TOMMY DODD, WHERE PASTE OR STARCH IS ADDED TO CLOTH

An interesting development has taken place in connection with this industry, for in 1902 there were 96 tobacco factories in North Carolina, and in 1922 the number had been reduced to 16, all of which are located in the Piedmont section. The results of the elimination of the small plants are the huge plants of the Reynolds Tobacco Company at Winston-Salem, the American Tobacco Company, and the Liggett and Myers Tobacco Company, at Dunham. There is shown in Fig. 7 the general type of factory building used by the Reynolds Tobacco Company for the manufacturing of tobacco products. Some new buildings have been constructed of reinforced concrete, and these are a great improvement over the majority of the buildings in which this company at the present time conducts its manufacturing operations. The city of Winston-Salem, in which the company is situated, reported over three-fourths of the value of tobacco products for the state of North Carolina in 1922. This city in the same year claimed a population of some 55,000 persons of which the Reynolds Tobacco Company is estimated to have employed some 10,000. At the close of the fiscal year on June 30, 1921, the tobacco taxes collected in North Carolina were $79,573,088 of which $50,405,781 or more than two-thirds, was paid by the city of Winston-Salem. The proportion of this huge sum paid by the Reynolds Tobacco Company was extremely large, and the extent of its activities can be estimated when it is noted from the above figures that approximately one person out of every six in the city was employed by this company. The dominating position that this company appears to hold in the city is an exceptional one. The author had a somewhat amusing experience with an official of the company, which possibly is indicative of its attitude toward visitors. A request had been made to see the interior of the plant, which was promptly refused although the author stated that the only parts of the plant he wished to visit were those of general interest and not those containing any secret processes. He next asked permission to see the power plant and that also was promptly refused. He then asked for the privilege of walking along the streets in order that he might look at the outside of the buildings, to which consent was gravely given!

The marketing of the tobacco leaf is extremely interesting. It is brought in from the surrounding country by the tobacco farmers to be sold at auctions. In Fig. 8 is shown a typical group with the covered wagons which are still used in this section. The tobacco is piled in long rows in baskets approximately 4 ft. sq., and 6 in. deep, placed on the floor of a large single-story warehouse. The auctioneer with a group of buyers starts at the beginning of a row and walks slowly along the rows of tobacco-filled baskets. By the time he has walked the length of a basket, 4 or 5 ft., he has started the price, conducted an auction of that lot, and sold it. So rapidly are the baskets auctioned off that there is said to be a standing offer of $50 for any visitor who can understand anything that the auctioneer says! The competitive bidders for this tobacco represent the various tobacco interests of this country and some foreign interests. In 1922 there were



Courtesy of J. E. Sirrine & Co.

FIG. 5 TENTER RANGE

Courtesy of J. E. Sirrine & Co.

Fig. 6 Durham Hosiery Mills, Durham, N. C.

some 42,000,000 lb. of tobacco sold in Winston-Salem, which will convey an idea of the extent of the industry. When a lot of tobacco is sold the warehouse pays the farmer by a warehouse receipt, and deducts the amount of its commission for the sale, weighing fee, etc., the average amount being some 4 per cent of the gross sale price, the warehouse receiving the money for the tobacco direct from the buyers. The farmer cashes the receipt at a local bank and in most cases a large part of this money is spent in Winston-Salem for supplies, these local purchases helping considerably to increase the trade and prosperity of the city.

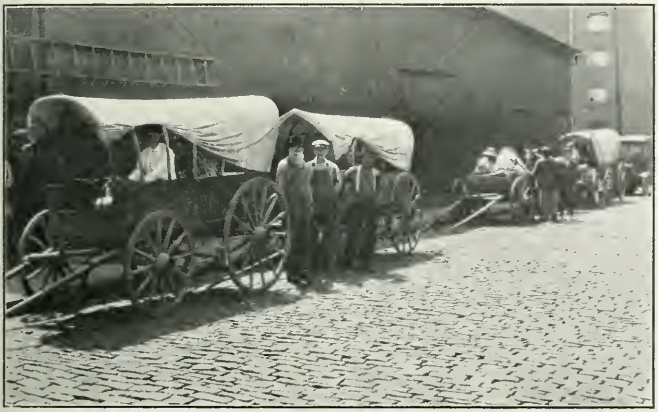
The making of cigarettes occupies a relatively large portion of the building and equipment of tobacco factories in this section. The following is a brief description of the general process, which requires a considerable amount of special machinery and in certain places a large amount of human skill and judgment.

The tobacco after being purchased from the farmer is hung on endless belts which travel through a long steel chamber. In this chamber it passes through a compartment kept at a relatively high temperature which drives out the moisture. It then passes through a compartment where it is cooled, and in the last compartment it is subjected to live steam. The tobacco is then considered to be "ordered". In the next process it is "prized," which means that it is tightly packed into large hogsheads by hydraulic presses. The hogsheads are of kiln-dried southern pine and are marked with the grade of the tobacco and the year. They are then stored in a warehouse where the tobacco mellows for some two years or longer. This tobacco, if properly "ordered," will still hold a certain amount of sap in the stem and twice a year will go through a natural "sweat". After the two years or more are up, during which "sweating" has been taking place, it is taken to a steam-heated "sweat-house" where it is kept for a few days, and then unpacked and taken to the "blending room" where the blending takes place according to a formula. It is then put through the "stemmers," which are machines that strip the stems from the leaf, and then put through a blower to remove any foreign substance such as sand and dirt. The tobacco is next taken to the drying oven where it is finally "ordered," and packed again in hogsheads ready to be made into cigarettes. If the cigarettes are to be made of several kinds of tobacco, such as Turkish and Burley and domestic blends, this blending takes place according to secret formulae and the leaf is then put through large rotating cylinders which mix it thoroughly. It next goes to the cutters, where it is compressed into a solid cake 4 in. square and shredded with knives. This shredded tobacco is fed into the cigarette-making machines, where the cigarette is made and cut to size. Some of the machines turn out 400 cigarettes per min., or 190,000 in an 8-hr. day. Then they go to the packing machines and are made up in packages which are put in cartons for shipment. They are then ready for the market.

Courtesy of J. E. Sirrine & Co.

Fig. 7 Factory Building of Reynolds Tobacco Co.

The manufacturing of furniture is another industry that has contributed materially to the growth of the northern end of the Piedmont section. The factories are mainly located at High Point, Winston-Salem and vicinity, and derive their raw material from the slopes of the Blue Ridge Mountains. In 1910 the value of the yearly output was \$11,232,900, and in 1922, this value had increased to \$30,288,761, an increase of 170 per cent. There are some 8697 people employed in the factories, and their product has been widely distributed throughout the United States.



Courtesy of J. E. Sirrine & Co.

FIG. 8 TYPICAL GROUP OF COVERED WAGONS WHICH ARE STILL USED IN THIS SECTION

The buildings in general are not as modern as those found in the textile industry, but considerable attention is paid to the layout and the routing of material. Many of the plants are quite large in size and their product is of a quality that has attracted considerable attention to this section from other parts of the country. Some of the factories are located on the outskirts of cities and have built their own villages for their employees. The men are paid a weekly wage instead of by piece-work, which is a trend directly opposite to that of the textile industry.

There are many other industries in the Piedmont section of considerable size, such as the cotton-seed oil industries, the lumber industry, which includes rough and dressed lumber, the manufacture of shooks, boxes, etc., the manufacture of commercial fertilizer and phosphate and sulphur at the plants of the Virginia-Carolina Chemical Company, and the manufacture of commercial fertilizer at the plant of the Swift Company. These miscellaneous industries require equipment, and men to operate them and the diversity of the manufacturing in this section assures it a certain amount of prosperity at all times. This industrial activity has brought to the Piedmont section branch offices of many of the big machinery companies and other large manufacturers of various products used in a manufacturing center, and here also are located branch offices of many large construction companies.

The next article of this series will deal with the favorable labor situation which has been responsible to a considerable degree for the growth of this section.

Straight-Line Production in a Meter Repair Shop

AFTER considerable study the Pacific Gas and Electric Company has rearranged their meter repair shop so that the meters travel in a continuous circuit during the various stages of repairing and testing.

A general order of the company covering periodical tests of service meters states that 15 per cent of the total meters in service must be changed each year and in addition there are a number of other meter changes ordered by the company. About 1200 meters come to the shop each year because of consumers removal and all newly purchased service meters are tested. Altogether approximately 45,000 meters a year or nearly 900 a week must be tested, repaired if necessary and retested, painted, and stenciled. The arrangement now being used in the shop eliminates several hundred feet of travel with consequent reduction of time needed for a meter to go through the successive stages, reduced costs and greater efficiency.

Fig. 1 is a graphic representation of meter travel in the repair shop. Meters enter the shop by way of the elevator at the lower right-hand corner of Fig. 1 and are left for 12 hr. so that they may become acclimated for testing purposes since it is essential that they be of the same temperature as the room in which they are tested. After this they go to the provers. (Fig. 2). The proving equipment consists of two 10 ft. standard meter provers such as are used by the United States government for testing purposes. The provers are equipped with modern air-raising devices which have superseded the old method of raising prover bells by hand power.

Index Number
658.58 Meter repair shop

The test made by the operator of the proving apparatus consists of a check run varying with the size and capacity of the meter.

After proving, the meter travels to the ripping benches where the top and back plates are removed.

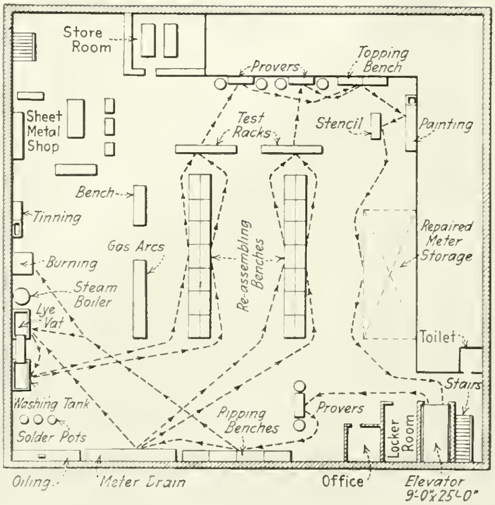

Store Room
Provers
Topping Bench
Sheet Metal Shop
Test Racks
Stencil
Painting
Bench
Tinning
Gas Arcs
Re-assembling Benches
Repaired Meter Storage
Burning
Steam Boiler
Lye Vat
Toilet
Stairs
Washing Tank
Solder Pots
Ripping Benches
Provers
Locker Room
Oiling
Meter Drain
Office
Elevator 9'-0"x25'-0"

FIG. 1 METER TRAVEL IN REPAIR SHOP

Then on specially built draining tables the water and condensation is drained from the columns and body of the meter. The diaphragms are tested under an 8 in. gas pressure. If they are satisfactory they are treated with a small quantity of a fine neutral oil which preserves the leather and gives it flexibility. If they do not stand up under the test the entire backs and fronts of the meters are removed.

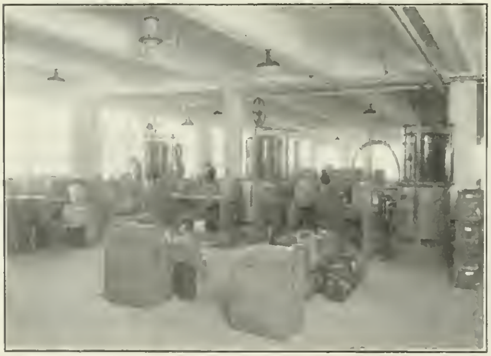


FIG. 2 PROVERS ARE EQUIPPED WITH AIR-RAISING DEVICES

The meter is sent to the lye vat where it receives a thorough scouring with caustic soda, is then washed and sent to the reassembling benches (Fig. 3). Here the valves are reground, stuffing boxes are repacked with fine Germantown wool which has been dipped in melted tallow and beeswax mixed in proper proportions, indexes are cleaned and examined, and other minor repairs made. If the diaphragms have been found to be beyond repair they are replaced by new ones. Parts that require it are retinned and all are replaced in the meter and resoldered, resulting in a meter that is in every way the equivalent of a new one.

From the assembly benches it passes to test racks to take a slow motion or flame test. This test determines whether the meter will register the passage of a small volume of gas and also detects any small leaks that may be present. The test is simple, consisting of connecting the meter in a line between a burner and the gas supply.

The meter than receives another proof test to determine its relative accuracy. This test consists of passing a measured volume of gas through the meter and noting the error in registration. Each meter is adjusted to register within ½ of 1 per cent on runs through open and check outlet connections.

After this test has been passed successfully the meter goes to the topping bench where the top and back plates are replaced and the meter put into condition for painting and storage. Meters are painted by dipping, since this has been found to be quicker than by using the brush (Fig. 4). Since care must be exercised that no paint gets on the index, the top of the meter is not dipped but is hand painted while the rest is draining. After the paint has dried all meters are stenciled with the company's serial number.

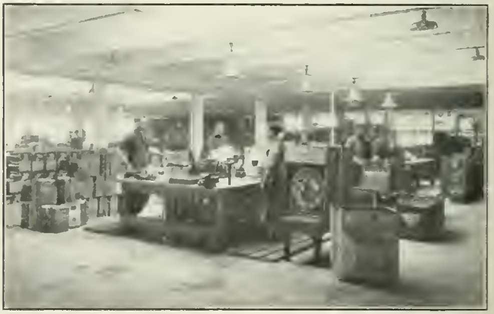


FIG. 3 REASSEMBLING BENCHES

Meters that have been repaired, tested, and painted are stored in the distribution room, according to size and also date repaired, until needed again for service.

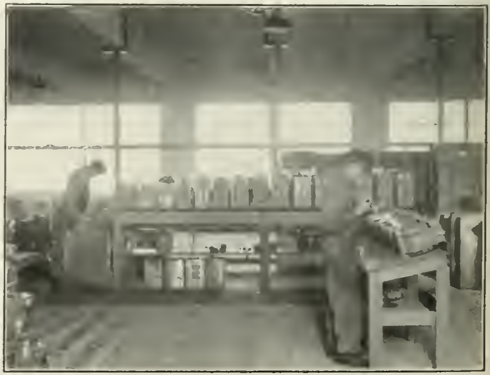


FIG. 4 PAINTING AND STENCILING METERS

Administrative Control and Response

The Unity of Management[1]

By WILLARD E. HOTCHKISS

Executive Director, National Industrial Federation of Clothing Manufacturers

IN business concerns that have grown up under a single management there is frequently found a certain pioneer type of all-dominating executive who combines with authority and driving force such mastery of detail that he is able to embody in his own person the elements of administrative control. In other cases, as a business has grown, a group of executives through the habit of thinking and working together have created a sort of joint personality through which unified control has been maintained.

Personal Control

Personal control of this sort is usually forceful, but in many cases it lacks balance. An individual or a small group that has retained personal control after a business has come to have an intricate structure of divisions and subdivisions is likely to focus attention on certain details that come within the scope of their own experience and to neglect other details that may be more important. A more serious weakness of personal control is the stake which it places on the hazard of human life. The very qualities which enable pioneer management to retain personal control tend to defeat the transmitting of such control to successors.

By way of paradox, it may happen that the development of personal control comes in the second generation rather than the first. One large and highly organized business has come to my notice, in which a general executive when he saw the business becoming complex, secured an understudy to carry most of the detail for which he was responsible. In these circumstances the understudy was compelled to become a master of detail, but under the inspiring leadership of his chief and with the aid of an unusual mental equipment, he became also a master of policy and is now an unusually able general executive. He is, however, a type that tends to attract control of detail to his own office; unless he should later develop the rare ability of his predecessor to train and inspire a successor, the kind of control that now obtains in the business cannot be expected to perpetuate itself.

There are few executives, be they second generation or first, that have the capacity to control the diverse activities of a large modern business by means of personal mastery of details. Failing this, control must be exercised through a staff. The composition of a staff may vary according to the nature and traditions of a business, but it will normally include the heads of important departments like production and sales, and in many cases includes advisers such as consulting technical or industrial engineers, lawyers, and outside accountants. In certain circumstances, also, creditors are represented. Whatever special services are attached to the general manager's office, as well as the viewpoint of stockholders, are reflected in the staff through the general executives of the business.

Index Number
658.1 Executive control

Theoretically, staff meeting is a place where the various influences of a business can be set off against each other, where ideas can be picked to pieces until those that survive take shape in wise decisions and well-considered plans for making them effective. While staff organization is usually thought of as an instrument for unifying policy, it is clear that unity of policy can exist only in name unless decisions reached in staff councils are carried out in the same spirit in which they are made. This means that from the staff there must be reflected back through the line the impulse of a central control which keeps practice and procedure consistent throughout all branches of a business and in harmony with general policy.

The question to what extent staff organization achieves its theoretical aims in any given case must be answered with reference to the circumstances of that case. The efficiency of a machine depends on the people who operate it. Special influences that tend to undermine management unity may be as active with a staff organization as without it, and it is inevitable that at times particular interests that may not coincide with the general interests of a business should be represented on the staff with a driving force that has to be reckoned with both in the making of policies and in carrying them out.

Control of Specialized Functions

Any highly organized business today has numerous specialized functions, each in the charge of technicians in the particular field. The question arises: How can a non-technical management co-ordinate such functions? Management, of course, has resort to its own technique as represented by such devices as a scientific budget, perpetual inventory, standard accounting, and comprehensive statistical records and reports. Good management will make judicious use of such of these devices as fit the particular situation.

But there is a human side to control that goes beyond the scope of mere mechanical devices, and it is on this human side that control is most likely to be ineffective. Mechanical control depends to an appreciable extent on the use of language, but the people to whom language is addressed do not always draw from it the meaning it is intended to convey. A teacher of literature once expressed surprise that a certain narrowly orthodox student showed so much approbation of Emerson. Closer inquiry showed that he was filtering his Emerson through John Wesley. Management policies and instructions frequently undergo similar purification in transmission.

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[1] A preceding article on "Unity in Management Policy" appeared in MANAGEMENT AND ADMINISTRATION for July, 1924, p. 17.

Importance of Personality

In the last analysis the human aspect of control is a matter of personnel, both of the people who exercise control and those who come under it. A strong personality in any department of a business may exert an influence even from a minor position that will greatly promote or impede administrative control. Per contra, a weak person by failing to exert an influence he is supposed to exert may upset the best of paper plans. One of the most essential steps in unifying the administrative procedure of a business is to locate the less obvious centers of influence and to make sure that all the hidden forces are squarely behind the kind of practice and procedure required to make general policies harmoniously effective throughout the business.

Among the circumstances that tend to disturb the balanced control toward which staff organization is directed is the fact that management is frequently centered in a person who has a departmental slant. A sales manager who has come to bear the label and carry the responsibility of a general executive is likely in his thinking to be a sales manager still. If a general manager has come up from the production department he may easily overweight the views and problems of major and minor executives in production. If he was trained as an engineer or a lawyer he tends to approach decisions from the angle of his original profession. Finally, if he has grown up as a pioneer general executive of the sort referred to above, the tradition of that position usually sticks to him even though personal control has been replaced by staff direction on paper.

Sales Department Influence

The sales department in a business is almost always in a position to exert a strong influence on staff councils, irrespective of the background of the general manager. The reason is not far to seek. Prosperity centers in sales. A successful sales department produces profits, within limits, even in spite of unwarranted burdens elsewhere; except for sales the activities of all the other departments are without meaning. In these circumstances a sales executive is frequently able to marshal arguments for his views which other departments are reluctant to over-ride. By the same token the sales department is likely to assume considerable latitude in executing staff decisions. If the relative independence of a sales department is a matter of policy that rests on mature council it need not seriously conflict with proper administrative control. But when, as frequently happens, the dominance of sales influence proceeds from uncorrected assumption, an atmosphere is created that tends progressively not only to weaken staff control but to encourage loose administration and wasteful practice within the line organization of the department.

In certain cases tradition attaches such importance to some key position in a business as to give it substantial immunity from central control. I have recently had occasion to consider the relation of designing to general policy in the manufacture of men's clothing. Designing is the function around which the manufacture of ready-made clothing has developed, and the designer in the clothing business has traditionally occupied a strategic position. A designer's worth to a business is supposed to reside in his skill and artistic sense, but at the same time his function is to design models that the public will buy. Designing is a kind of work in which business and temperament easily become confused and it is never possible to say accurately to what extent a designer's sales motive is diluted by certain artistic whims.

Control over designing has had to make headway against strong resistance based on tradition and general impressions. From the designer's standpoint constant experiment and variety of models are sure to bring returns which the records may not reveal. Obviously there can be no business without sales and no sales without designing, and so a chain of plausible theory is built up through which in many cases a large part of the sales program and shop practice for a house has been predetermined in the designer's workroom. Expressed in general terms this means that important executive functions are lodged with a specialist who usually lacks qualification for management responsibility.

Relation of Control to Costs

Without proper control the cost of sterile models may run to large amounts. The piece rate structure in a clothing factory is built up from base rates for all standard operations. New operations involve differentials from the base. Even with the best possible management in the shop, deviations from habitual practice tend to add to direct labor cost out of all proportion to the mere increase in the amount of work. Moreover, small unit output per model disturbs shop balances and tends to impede the flow of work through the factory. It also increases cost of supervision. Every production process that makes for efficient shop practice and proper cost is hampered by a multiplication of slow selling models.

Control in this instance requires accurate records, model by model. It involves careful budgeting of that part of designing that represents laboratory expense chargeable to overhead, as distinct from unit factory cost. Control over adding and withdrawing models is affected by style and house policy, but here, too, decision as to what models should be pushed needs to rest on the fullest possible use of recorded data, both in respect to sales and to relative cost. It goes without saying that such decisions are the province of a staff or central management, as they are too important to be arrived at by any single functional specialist.

The reaction of designing and sales on shop practice leads into the question whether to control production by sales or sales by production. In a number of competitive industries it has been assumed that a production department existed for the purpose of manufacturing goods to supply whatever demand the sales department was able to create. It may be a moot question in any case whether the manufacturing waste that results from adjusting production to fluctuations in sales is greater than the possible loss of sales or the burden of moving surplus that results from following a fixed program of manufacture. The tendency in well-managed concerns, however, seems to be towards adopting a reasonable manufacturing program based on equipment and careful sales estimates, and then working out a careful program for sending goods through the factory. It is clear that a policy of adjusting sales activity to a production program has the effect of tempering the influence of sales viewpoint in reaching staff decisions.

Centralizing Control

The degree to which control of departmental operations should be centralized in a general office is largely a technical question, the answer to which is found in the nature and size of the business and the background from which its organization has been built up. In some cases the answer will be found through actual experimentation in which there is a comparison of costs in units of different size and forms of organization. The growing complexity of modern business, and the magnitude of the interests combined under one ownership are creating strains which mere organization technique can scarcely compensate. Viewed in these larger dimensions, policy and control are not two problems but merely two phases of the same problem. The directing intelligence essential to handling the problem successfully must include varying combinations of technical equipment and human insight in the central management and at strategic points throughout the business structure.

Securing Proper Response

Wise management considers not only control but response to control, and this tends to replace arbitrary authority with human intelligence as an instrument of control. In this connection a recent experience related by an executive of a nation-wide business is illuminating. In order that the business might be in a position to expand its equipment to meet growing demand, it became necessary at specific intervals for the operating force to keep an extra record of service rendered. As a departure from routine practice this requirement caused irritation and finally resulted in cessation of work throughout a large unit of the company. Central management, in trying to resolve the difficulty by the human intelligence method, discovered that in enforcing the practice of recording traffic the management of the local unit had specifically denied the force any information concerning the reasons for the extra service and had repeatedly impressed upon them that it was their duty to perform the service and not ask questions about it. Careful explanation of reasons underlying the requirement changed the leader of the revolt from a rebel to an ally, and the object lesson enabled the central management to take a big forward step in selling the human intelligence method to subordinate executives.

In a broad sense, both control and response to control require some understanding not only of short-time requirements but of the long-time ends towards which policy and practice are directed. In those large concerns whose activities frequently are as complex and many-sided as society itself, this is not a simple specification to execute. In the last analysis it becomes a problem in education and personnel. As such it harks back not only to selection and placement but it involves also a constant program of education. How to give to the different elements in a business organization a sincere and intelligent interpretation of policy, procedure, and aims without encountering the blight of propaganda, is a problem with which many large concerns are earnestly struggling.

Plant education is a special phase of the general problem of personnel, adequate discussion of which would carry too far afield. One of the main objects of such education, whether carried on in systematic courses or merely as a by-product of personnel management, is the maintenance of mutual understanding and mutual confidence, which after all is the foundation of control.

The tendency towards bringing larger and more complex business units under joint control makes the building up of mutual understanding and confidence more and more a determining factor in successful management. The variety of interests and activities that fall within the province of a single management makes it necessary to utilize the most perfect organization technique that can be devised, but by the same token it is scarcely possible through technique alone to maintain in large scale business the kind of control that will insure uniform purpose and uniform efficiency throughout the business. To this end, business technique must have behind it in management the impulse of a large caliber intelligence operating in an atmosphere of understanding and confidence.

THE point of view presented by Mr. Hotchkiss in this article and in the preceding article in the July issue of MANAGEMENT AND ADMINISTRATION is of vital importance. Unfortunately, however, few industrial managements have ever had the possibilities of unit of management and control brought before them in such a way that they make a definite effort to secure it. Nearly every executive realizes that only by perfect co-ordination of the sales department, the production department, and the financial department can the entire organization function at its highest efficiency. Too often, though, this realization results in no positive action by any executive toward securing better co-ordination. Mr. Hotchkiss' articles offer assistance to managements anxious to bring it about.

—THE EDITORS

Standardization of Screw Threads for Fire Hose Couplings

Index Number
658.516 Industrial standardization

CONDITIONS which permit conflagrations to go unchecked, which may wipe out whole sections of cities and cause great loss of human life while plenty of fire-fighting apparatus is at hand but useless because of couplings which will not fit, can and must be eliminated, and an important step in the elimination of such conditions has been taken in the approval by the American Engineering Standards Committee, of National Screw Threads for Fire Hose Couplings.

The approval of this standard, which had been submitted under the leadership of the National Board of Fire Underwriters, the National Fire Protection Association, the American Society of Mechanical Engineers, and the American Water Works Association, marks for the first time a national agreement on tolerances or limits of accuracy necessary to secure interchangeability in manufacture. The present lack of uniformity, which has often led to such disastrous results, is due to failure to follow the national standard, and to noninterchangeable manufacture. It has been shown in a startling way by the exhibit of a single collection of 600 sizes and variations of fire hose couplings.

That this condition constitutes a real menace has been shown in numerous conflagrations in which outside assistance was of no avail because the hose of neighboring fire departments would not connect to local hydrants.

The most important example of this was the great Baltimore fire of 1904. When the Baltimore fire department found that the conflagration was getting beyond control they called upon Washington, Philadelphia, and New York for help. The fire-fighting apparatus from the three neighboring cities was on the ground in a remarkably short time, but the hose could not be connected to hydrants—the couplings did not fit.

Following the earlier great Boston conflagration of 1872, where conditions were much like those in Baltimore, efforts were made to bring about national uniformity in hose couplings. Unfortunately these efforts led to the introduction of competing standards instead of to uniformity. Finally in 1890, the National Association of Fire Engineers took action, as the result of which slow but steady progress toward national uniformity has been brought about.

In 1919, the National Board of Fire Underwriters undertook intensive local campaigns for the introduction of the standard, and a large amount of practical field work has been accomplished in numerous cities and towns. Tools were developed by which the threads on fire plugs and hose couplings that did not differ too greatly from the standard, could be changed over to the standard form by a single operation.

More than 700 cities and towns have not only decided to adopt the standard, but have carried out the practical steps necessary to put it into working order, while numerous other cities, towns, and counties have officially decided upon its adoption. The state of Oregon has made its use mandatory by legislative enactment, and a similar measure has been favorably reported in the Massachusetts legislature. Nevertheless, a very large amount of work yet remains to be done before America is free from this wholly unnecessary fire menace. About three-fourths of the 8000 cities and towns in this country having fire protection, still have non-standard threads.

The difficulties which at present beset the railroads form a striking example of the existing confusion. Each railroad, in order to protect its property, has to provide connections for each of the non-standard threads in the cities and towns through which its lines pass. For example, the Seaboard Air Line Railway has to carry in stock, 29 different non-standard hose couplings, together with special fittings or "adapters" to enable each of these to be connected with the standard form of coupling.

The most important new feature in the present form of the standard as approved by the American Engineering Standards Committee, is the national agreement on the complete set of tolerances or the limits of accuracy of manufacture. These make it possible to insure complete interchangeability. Heretofore manufacturers have worked almost entirely from samples of couplings submitted by the purchasing authority, instead of by the use of accurately made gages. This has been a prolific cause of non-uniformity since old couplings, hydrant nipples, and caps are not reliable as test pieces, owing to wear and corrosion.

The standard includes precise specifications for gages for the use of manufacturers and city authorities in controlling manufacture, and acceptance tests of couplings. These include "go" and "not go" gages for the sizes and form of threads.

This phase of the problem is thus seen to be very similar to that encountered during the war in the production of quantities of interchangeable ammunition, during the earliest stages of which, due to a lack of adequate gaging systems, great losses and serious delays were experienced. It was only after the introduction of such a gaging system that enormous mass production of acceptable material became possible. Serious consideration is now being given to this same problem as a means of furthering mass production throughout the mechanical industries, and a representative technical committee is now developing a uniform gaging system to this end, under the auspices of the American Engineering Standards Committee.

In connection with the standard, the sponsors are issuing two publications: one for the use of fire chiefs and superintendents of water works, and the other, for the guidance of manufacturers.

Notwithstanding the great amount of work which has been accomplished by the organizations already mentioned, much yet remains to be done that will require continued and united effort. Commercial and civic organizations have a very real responsibility in bringing about the adoption of the American National Screw Threads for Fire Hose Couplings by their own cities and towns, where assistance of other fire departments may at any time be sorely needed.

Is the Credit Department an Asset or a Liability?

Methods of Measuring Its Value to an Organization

By J. W. HALLMAN

Credit Manager, Sun Oil Company

A CREDIT department is an asset to any concern extending credit, if its acceptance of good business approaches the maximum amount of bona fide orders which it is possible for salesmen to secure, with only a small loss in bad debts, a minimum loss of customers in handling the accounts, and at an operating cost low compared to the extent of the business.

A credit department is a liability, if it fails to accept the proper amount of business safely possible to accept; or has an excessive bad debt loss; or causes the loss of customers through improper methods; or operates at too great a cost to the business.

Factors in Credit Department Effectiveness

Briefly stated, these are the factors determining whether a credit department is an asset or a liability to any business. But naturally some interesting questions are raised:

1. What constitutes the maximum amount of business that shall be accepted?
2. What is the minimum, or proper, bad debt loss?
3. What is a minimum loss of customers by the credit department?
4. What should it cost to operate a credit department?

These questions will be taken up in order.

In any line of endeavor there is a potential field or market, developed or capable of being developed, for that particular commodity or service. That field or market constitutes a potential unit of 100. If there are 10 competitors doing business in that field or market, all being on an equal basis as to facilities, service, qualities, prices, etc., theoretically there would be a unit of 10 as each competitor's share. But there are set to work on that potential unit of 100, 10 competitive sales organizations, each being keyed to the highest pitch of enthusiasm and inspiration, often with bonuses and commissions as an incentive, to secure the greatest possible amount of this 100 unit.

In this 100 unit, though, there are all kinds and grades of credit risks, some of whom will actually fail, (the distribution of failure being: from incompetence, 33.7 per cent; lack of capital, 34.2 per cent; fraud, 4.2 per cent; and other causes 27.09 per cent—Bradstreet, 1923), some will require litigation to collect, some will be extremely slow pay and therefore unprofitable, some will be fair to good risks in the making, some will be fair pay, some good pay, some discounters.

It naturally follows, then, that as prices, quality, service, salesmanship, or other purchase inducements to the customer, fail to measure up to the standard of competitors' inducements, the lower will become the grade of credit risk of the customers sold, in order for that house to secure its share of the 100 unit. When purchase inducements to the customer are on a par with, or superior to, those of a competitor's inducements, it is easiest to sell to high-grade credit risks with correspondingly lowered credit department expenses. When purchase inducements to the customer do not compare favorably with those of competitors, usually only the poorer grade credit risks can be sold, and that immediately throws a greater burden and responsibility upon the credit department.

Index Number
658.882 Credit department

As a general proposition it is usually estimated that at least 90 per cent of the business submitted for credit approval is of good or fair grade risks and that not over 10 per cent of it should be of a class that requires out-of-routine treatment by a well-organized, properly-functioning credit department. In this 10 per cent will usually be found, in varied ratios with different houses, about all of the off-grades above mentioned. As purchase inducements to customers compare less favorably with competitors' inducements, they will usually tend to disarrange this 90/10 ratio, and lower it sometimes until a 50/50 ratio is reached. When this latter ratio is reached, or anything approaching it, it is safe to say that a pretty efficient credit department is required to handle it successfully and keep the business out of bankruptcy.

Therefore, a credit department that accepts risks submitted on a grade ratio of 90/10 or downward, as above described, rejecting, or selling for cash only, the worst grades, may be said to be accepting the maximum amount of business for its house.

The Question of Bad Debt Loss

What is a minimum, or proper, bad debt loss, is a much mooted question. Credit men are as a rule very vague and evasive when this question is discussed. The fact remains, however, that in 1923 there were 19,159 failures with liabilities aggregating $631,324,794 (Bradstreet), not to make mention of the many thousands of bad accounts, at least indirectly responsible for many of these failures, that were never collected. Then, when we add to that sum the "bad accounts" that were charged off in 1923 by approximately 2,055,458 business houses that did *not* fail, we have a bad debt bill, to be ultimately paid by the consumers of this country, that almost staggers the imagination.

If it were possible to obtain these figures and ascertain the average per cent loss to sales, taking into consideration that eighty-nine hundredths per cent of the total houses in business failed in 1923, we could arrive at a standard to measure this phase of credit work.

Perhaps the nearest approach to a correct per cent loss, in any case, is to take what is found to be the average loss by a number of houses in the same line over a period of 3 to 5 years. This should be accepted as a correct experience and should be used as a basis for consideration of bad debts in price computation. If this average were, let us say, 1 per cent, and a credit department did not exceed this average, and accepted business as above outlined, it could well be said to have sustained the minimum loss in its transactions.

Minimum Loss of Customers

The third question relates to minimum loss of customers. Let us assume that a credit department accepts business on a grade ratio of 90/10. If it loses—through its efforts to collect (when customers have been properly sold and service and materials are satisfactory)—any of the 90 per cent fair or good grade risks, it is certainly losing good material. If, however, a customer among the other 10 per cent, above described, is lost for future business in securing the money for the first transaction, or if the customer refuses to accept revised terms satisfactory to the seller, then it is hardly fair to charge the credit department with having lost a customer. It has merely failed to make a fair or good customer out of a doubtful one.

If, on the other hand, the credit department helps to make fair or good customers out of, say, 5 per cent or more of whatever portion of the doubtful class is accepted, it certainly then becomes a greater and greater asset to the business with the increase of this percentage remade into fair and good customers. Let us say a credit department accepts business on a grade ratio of 50/50, saves as good business for the house 25 per cent, and fails on the other 25 per cent. That credit department should be credited with having saved and built for the business 25 per cent of its customers, and not with having lost 25 per cent of them. A credit department should be charged with losing a customer only when it is the *avoidable* cause of losing a fair- or good-paying customer.

The fourth point, the cost of conducting a credit department, is, of course, largely predicated upon the kind and nature of the business conducted. Much depends also, as above intimated, upon the class of business the department is called upon to accept and handle. It stands to reason that if a large number of poor-grade credit risks is taken, the cost of operations will be much greater than where only select trade is accepted. If the credit department is making business possible with a poor credit class of trade, which is necessitated by some weakness in other factors of the business, the credit department is forced to carry part of the burden rightly belonging to some other department or departments. Therefore it should not be expected to operate as cheaply as when such a condition does not exist.

For the purpose of illustration, then, we may safely assume as a reasonably low cost of operation, 1 per cent of sales when business of a grade ratio of 90/10 is being accepted and profitably handled. Why the assumption of 1 per cent as reasonably low?

Underwriters of insurance on credits charge a special premium for, place rigid restrictions or penalties about, or decline to assume liability in connection with, any of what they designate as the off-grades, above referred to, under their insurance policies. This procedure is just as correct and proper as it is to charge an extra premium, or provide special safeguards, or refuse to accept responsibility, for an extra hazard under a fire insurance or any other form of policy.

Also, these underwriters cover, under the ordinary bond, only the losses *over* and *above* the normal loss of that particular business, determined by an average loss for a period of 3 or 5 years. The bond, in addition, usually provides that the company be given an opportunity to collect the losses, and that losses be reported for collection purposes within 65 days from due date, for which approximately the legal collection rates are charged in addition to the premium. The legal rates for collecting are 15 per cent for amounts under $300, 8 per cent for amounts between $300 and $1000, and 4 per cent for amounts in excess of $1000, making the average legal rate 9 per cent (not taking into account apportionment of percentages by amounts of losses). That places a pretty high premium on time in credit granting.

The managements of various lines of business place a still greater premium on time when they offer ½, 1, 2, 3, 5 and in extreme cases 10 per cent for cash within, usually, 10 days from date of shipment, paying actually, at these rates for 10 days' time, from 18 to 360 per cent per annum on the amount.

Is it not true, then, that 1 per cent of sales is a reasonably low cost for operating an efficient credit department in the average manufacturing, jobbing, or wholesale business, to collect the bulk of moneys on sales in the intervening period of from 10 to 60 days? Is it not a cheap collection rate? The percentage on a retail business will run higher.

Let us now take up the main question of our discussion: "Is the credit department an asset or a liability?" Taking the above premises, or conclusions, to be approximately correct as a general average proposition, let us see what we actually arrive at on, say, a $25 000,000 per year business. Collection costs would be as follows:

METHOD OF FIGURING COLLECTION COSTS	COMPARATIVE COLLECTION COSTS
Cost, figured on collections by credit department on basis of 1 per cent of sales on 90/10 grade ratio	$250,000.00
Cost, figured on collections on basis of accepting only customers discounting, on terms of 1 per cent cash 10 days = 36 per cent per annum, on monthly sales of $2,083,333.34	750,000.00
(This would probably eliminate 75 per cent of the business on an average concern's books).	
Cost on lowest legal rates, 4 per cent.	1,000,000.00
(At least this rate would apply if no effort were made to collect at all in the first 60 days on 30-day terms, accepting any and all business submitted, plus a probably ruinous loss ratio for bad debts).	

By the first method, with a loss, on account of bad debts, of 1 per cent, the total cost would be 2 per cent of sales for credit operations and bad debts.

Under the second method there would still be the hazard of the average loss by actual failures, which according to Bradstreets (by percentage of failures to all business) from 1893 to 1923, inclusive, averages one and one-hundredth per cent per year. It is quite probable that by this rigid selection of accounts the loss ratio would be practically nil, yet the cost of operations would be 3 per cent of the annual business, plus greatly increased sales and other expenses, and the necessity of having an article or service that could stand severe competition. And there still would have to be a credit department to do the selecting.

Under the third method there would have to be a sales force to sell, and some one to look after what collections were made. The cost of operations would still be at least 4 per cent, with an extremely high ratio of losses in addition.

The foregoing forms a basis upon which to determine the worth of a credit department. While the actual figures (used only for illustration) show an advantage of 3 to 1 and 4 to 1, respectively, in favor of the conservatively conducted credit department, that advantage may be increased as cost and loss percentages are decreased, and the 90/10 grade ratio is lowered to take in a greater percentage of bona fide business on terms that are safe. To lower the grade ratio is largely a matter of having customers of doubtful grades accept satisfactory terms and then seeing to it that those terms are enforced as nearly as possible. Here is where the arguments on question 3 apply with particular emphasis.

It is possible under proper management to obtain much better results than the general and average figures and percentages above shown. Experience has proved this to be so. An actual case may perhaps with profit be cited, where the bad debt losses were about three-tenths per cent, and cost of operations about four-tenths per cent on a risk grade ratio of better than 75/25, with few if any good or fair-paying customers lost by improper methods of the department, and a high percentage of sales on poor credit risks developed into good ones. The total combined cost of operation and bad debt losses amounted only to seven-tenths per cent, while it is stated the sales price of the commodity of that particular house had been loaded by 2 per cent for bad debts. An actual profit of one and three-tenths per cent was realized on that feature of the business.

Unable to switch the accounts to cash terms, that same credit department had also rejected three-tenths per cent of sales on credit that subsequently were shown to be "bad" accounts and if accepted would have been losses. This rejection added another three-tenths per cent of sales as an actual worth-evaluation to the credit department. On this latter feature, the sales manager argued that had the "bad" three-tenths per cent been accepted, with no credit department expense, the loss to the house would have been one-tenth per cent less than it was. The trouble with his argument was that, like the child, he expected to have the cake and keep the penny. He forgot that more than 25 per cent of doubtful credit business had been accepted from his salesmen, and profitably handled by the department.

A good credit department can indeed be an asset to any business—a real profit-earning asset. It takes an exceptionally poor one to rank as a liability.

Material Handling in Making Fiber-Board Boxes

Index Number
658.281 Material Handling

THE problem of material handling is tied up closely with three other phases of economy in production—correct layout of plant for direct routing, short travel of material in process, and the use of automatic, labor-saving machinery.

Direct routing saves not only time but also a big investment in handling equipment, or a heavy cost of hand labor and endless confusion of operations where many truckers are required. Short travel saves both time and money and it is needless to dwell in detail on its advantages. Wherever possible, automatic machinery is designed with feed and discharge mechanisms to insert and remove materials, and to this extent it becomes practically a part of the mechanical handling equipment.

The accompanying photographs, taken in one of the plants of The Paraffine Companies, Inc., illustrate the foregoing statements. This particular plant is devoted to the manufacture of fiber-board shipping cases.

Large rolls of paper are delivered to the solid fiber-board and corrugated board machine, shown in Fig. 1, by means of an electric hoist traveling on an overhead single I-beam runway. The hoist is floor-controlled and handles the rolls by means of a chain-sling. As the travel of the hoist is short, power is most conveniently obtained by means of a cable plugged into a wall socket. There are 8 shaft-bearings for rolls on the frame of the board machine, which eliminates the necessity of shut-downs when changing the rolls.

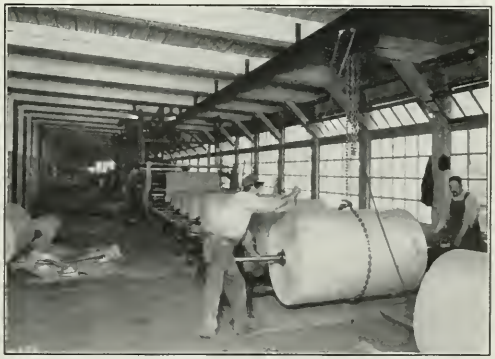

FIG. 1 ROLLS OF PAPER ARE DELIVERED BY ELECTRIC HOIST

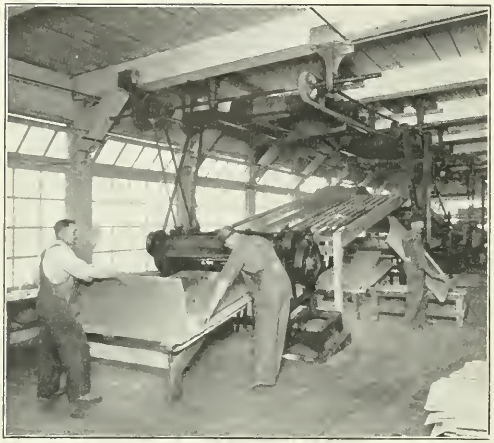

Fig. 2 Fiber-board Machine

Fiber-board is delivered from the machine three sheets at a time, as in Fig. 2. These sheets are ready trimmed to the proper size for the containers to be manufactured. Four men are required to operate the board machine.

As the sheets are delivered they are registered on an automatic counter, and are piled on skids or platforms, 1000 to a platform. Lift-trucks are used to move these skids to the next operation, which is that of printing.

A view of the handling and processing in the printing department is shown in Fig. 3. Two-color, rotary cylinder presses are used and the customer's name, brand marks, cautions for care in shipment, and other data as required, are printed on each sheet. One operator feeds each machine, one runs it, and a third stacks the printed sheets as they come out of the press.

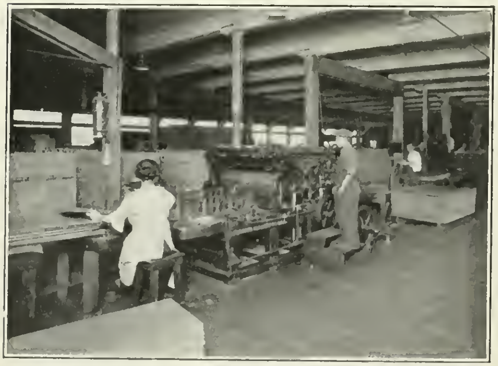

Fig. 3 Handling and Processing in Printing Department

From the printing presses the sheets are taken to the scoring machines. Fig. 4 shows machines used to handle the smaller lots of "runs". Larger lots are put through two-way scoring machines of special design. As a further labor-saving development, these large lots are carried from the printing presses directly to the two-way scoring machines by means of special conveyor systems. Lift-trucks and platforms are used to handle the smaller runs illustrated in the photograph.

The final operation in container making is that of stitching the joint. This work is done on shipping container box stitchers specially designed for this kind of operation. It consists of fastening the seam with copper clips, cut from a roll mounted on the machine, and inserted and clamped automatically. For the large boxes shown in Fig. 5 two operators are required.

Completed boxes are dropped on the floor alongside of the stitching machines, as finished. They are then gathered up and taken over to tables adjacent to the machines, where they are tied with the twine, usually in bundles of 10. Finally they are stacked on platforms and taken by lift-trucks to the shipping department.

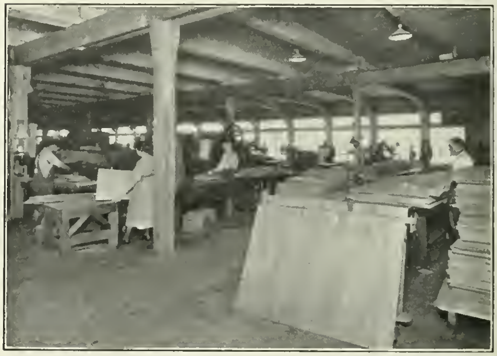

Fig. 4 Scoring Machines for Small "Runs"

Throughout the entire process of manufacture direct routing is followed. By this means unnecessary handling of stock has been eliminated. Machine layout was planned along these lines and also for the shortest possible travel of material between processes.

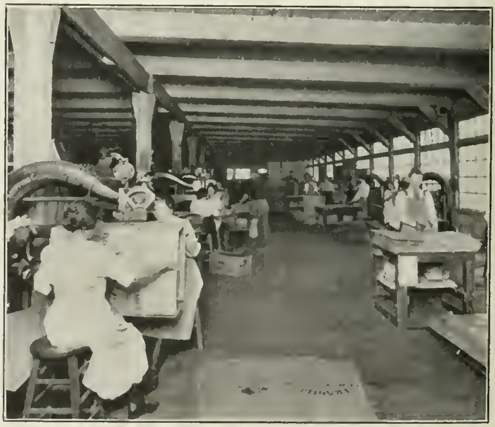

Fig. 5 Shipping-Container Box Stitchers

The Working Value of the Economic Forecast

By PARK MATHEWSON

Vice-President, Bankers Development Corporation

THE fundamental importance of economic forecasting will hardly be questioned. Alternating periods of prosperity and depression affect the greatest and the smallest business units alike. All classes and sections of society are influenced by the conditions of employment and wages, speculation, and price change. Not only the income and standard of living, but the efficiency and ambition of the average worker are greatly influenced by the extremes of depression and prosperity which periodically occur in the business world. The advantage of a forecast which points out in advance the approach of these changes is obvious.

There can be, of course, no perfect forecasting system. Even with the best facilities there would be a percentage of guesswork. But, as is the case with the Weather Bureau, even partial success in foreseeing conditions is immensely worth while and should eventually lead to at least a partial steadying of the business cycle swings. The gathering from the key industries by the government, of estimated or budgeted figures of their *demand* and *supply* for a number of months in advance would allow an approximate estimate of where the surplus or deficit might be expected to occur in materials, merchandise, men, money, machinery, etc. To some extent, the results shown by this forecast might be forestalled, or at least modified, so as to prevent the extreme swings of the cycle.

Huge Periodic Losses Largely Avoidable

The terrific strain upon the economic system in periods of depression, is indicated by the estimates of the National Bureau of Economic Research. According to these, in the 1920-1921 depression the losses in the United States alone were at least $6,000,000,000.

Much of this loss could have been avoided had the men under whom the estimates were made analyzed economic history, preceding conditions and the probable outcome, and properly budgeted their businesses. The natural reaction following the post-world war period of inflation was aggravated by unsettled conditions in Europe. Visions of foreign trade, far in excess of actual purchasing power from abroad, had stimulated our industries to feverish expansion. Without clean-cut plans or budgets, corporations vied with one another in bidding up the prices of raw materials and labor. These conditions reacted on the domestic situation when the buyers' strike was inaugurated in the summer of 1920 by the famous "overalls parade". Manufacturers who had confidently expected to pass along their high costs to the public were confronted by an almost absolute cessation of demand and drastic cancellation of orders in hand. Then there was serious trouble. Uselessly swollen inventories, in most cases purchased on bank credit, could not be liquidated except at enormous losses and after long delays. Probably from one-quarter to one-half of the larger enterprises of this country found themselves virtually at the mercy of their bankers. The term "frozen credits" became a standard expression for the unofficial moratorium which existed in many lines of trade.

Index Number
338.97 Economic forecasting

Typical Income Statements, 1913-1922

The severe results of the depression of 1921 can best be visualized by noting the effects of this abnormal period on the earnings of some of the largest corporations (Table 1)—companies which, because of their very size, might have foreseen trade changes far in advance of the small business organization, had they adequately studied conditions and adequately scheduled their needs.

TABLE 1. TEN YEARS' NET EARNINGS AVAILABLE FOR DIVIDENDS
(000 Omitted)

YEAR	GENERAL MOTORS	GOODRICH RUBBER	U. S. STEEL	COLUMBIA GRAPHO.	AM. AGR. CHEMICAL
1913	$7,459	$2,599	$81,216	$....	$2,592
1914	7,249	5,440	23,496	350	3,065
1915	14,457	12,265	73,833	1,370	3,675
1916	28,789	9,568	271,531	1,523	5,445
1917	24,780	10,544	224,219	634	5,546
1918	14,825	17,189	137,532	819	8,111
1919	60,005	17,304	76,794	3,624	4,158
1920	37,750	2,711	109,694	2,551	5,284
1921	*38,680	*18,983	36,617	*4,678	*11,158
1922	51,496	3,047	39,653	*3,394	*1,124

(*Indicates deficit.)

Of the above companies (among the leaders in their respective industries in those years) only United States Steel failed to report a deficit in 1921—the showing of that company being due to the policy of stabilizing its business through scheduling and the accumulation of orders ahead. Two companies, it will be noted, continued to show deficits in 1922, one of these—Columbia Graphophone going into a reorganization in 1923.

Effects of the Depression

To summarize, the losses of 1921 were due to a combination of interlocking factors:

1. Decline in sales due to overstocking of the shelves of jobbers, wholesalers, and retailers.
2. Collapse of our foreign trade.
3. Cancellation of buying contracts and orders for material on an unprecedented scale.

4. A decline of one-half to two-thirds in the prices of most raw materials, which decline was later reflected in the prices of manufactured goods.
5. The resulting great reduction in the value of inventories, which when written off the books as a loss, in most cases greatly increased the losses from the year's operations.
6. The calling of bank loans.
7. The inability of many corporations to collect from their own debtors.

The drop in the prices of raw materials was undoubtedly of more serious consequence to the financial position of the companies than the decline in gross sales. The inventory problem therefore deserves special attention. The figures for the above companies, for the four years 1919-1922, inclusive, are shown in Table 2.

TABLE 2. INVENTORY CHANGES 1919-1922 (MILLIONS OF DOLLARS)

YEAR	GENERAL MOTORS	GOODRICH RUBBER	U. S. STEEL	COLUMBIA GRAPHO.	AM. AGR. CHEMICAL
1919	$128	$54	$226	$9	$19
1920	164	72	258	23	17
1921	108	29	241	14	18
1922	117	22	220	7	13

Of the five companies, United States Steel and American Agricultural Chemical were the most conservative in their handling of inventories. The Steel Corporation increased but moderately; hence its losses were comparatively small. But American Agricultural, while it did not increase its inventories in 1920, had in the previous year carried a much larger amount than it had previously averaged, so that its policy was not so conservative as the figures would first indicate. Columbia Graphophone was the least conservative, and its losses were proportionately large and disastrous.

It is evident, then, that one of the main objects of economic forecasting should be to indicate commodity price changes, or in other words, the change in the purchasing power of the dollar. An accurate forecast of the comparatively shorter swings as well as the great periodic tendencies would be of inestimable value. The accompanying chart (Fig. 1) shows the historical changes in the purchasing power of the dollar brought about by the inflation of three great periods of conflict—the War of 1812, the Civil War, and the World War—and their aftermaths of deflation.

Forecasting, a Comparatively New Science

Prior to 1919 comparatively little effort had been made to correlate the great mass of trade statistics by which a general survey of current industrial conditions could be made possible. Most of the surveys that were made were based on inadequate conclusions not fully supported by statistical evidence.

The conditions through which business passed in 1920 and 1921 gave many business men a more wholesome respect for the application of economics to business. Executives everywhere desired to know the why and wherefore of fundamental trade changes. They wanted to be able to fathom the tides of business prosperity and foresee financial storms. As a result, the number of forecasting services increased and more scientific study of business statistics was undertaken by individuals and by statistical departments.

The development of business statistics has recently shown marked progress, but the work so far accomplished has only opened up new vistas in constructive analysis and its application to the production, marketing, and financial problems which call for solution. The various statistics compiled through established trade publicity channels should be supplemented by more complete and standardized reports from every important line of industry.

For example, the figures available to indicate the volume of goods moving into consumption have been mainly the reports of chain store organizations and some of the larger department stores and mail order houses. The results therefrom give merely a fragmentary picture of the country's *past* internal trade, which is nevertheless of greater importance than foreign commerce, concerning which more detailed and complete statistics are available. What is needed is more up-to-the-minute data on actual buying power—retail rather than wholesale.

Factors Used in Forecasting

The following figures (the majority of them published monthly) are those most used by forecasting services:

Transportation. Weekly car loadings, monthly gross and net earnings.
Foreign trade. Exports and imports.
Money and banking. Bond yields, money rates, debits to individual accounts, bank clearings and balances, the federal reserve ratios, loans and deposits, etc.
Retail purchasing. Credit Clearing House weekly reports of purchases. Statistics of mail order houses.
Credit conditions. Business failures (number and amount), Dun's and Bradstreet's reviews. Credit Clearing House reports.
Prices and wages. Various price indexes and wage averages.
Securities. Average prices for representative stocks and bonds, amount of trading on New York Stock Exchange, total dividend payments, amounts of new issues.
Steel industry. Pig iron production and unfilled orders of United States Steel Corporation.
Coal industry. Tons mined, etc.
Copper industry. Production, consumption, and available supply; exports and imports.
Oil industry. Production and consumption, exports and imports.
Other industries. Much miscellaneous data available, but not sufficiently standardized or made promptly available.[1]
Construction. Building permits issued by cities, etc.

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[1] See the monthly "Survey of Current Business" (U. S. Department of Commerce); also the Federal Reserve Bank publications, etc.

A movement for the more intensive compilation of current production statistics through the medium of trade associations, has been taken up under the guidance and advice of governmental agencies. Care, however, has to be exercised by the government to prevent such associations from using the information thus obtained in contravention of the laws for the fixing of prices or suppression of competition. On the other hand, many industrial firms still fail to see the advantage of having such information available, even though the earnings of individual firms are not disclosed.

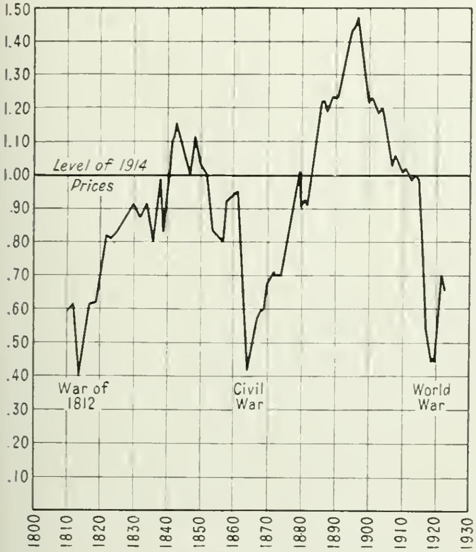

FIG. 1 HISTORICAL TREND OF THE DOLLAR'S PURCHASING POWER

The movement deserves expansion as one of the most practical means (apart from a perpetual census by the government, which would involve prohibitive cost and delay) for obtaining the trade statistics on which a really complete forecasting system can be based. Industrial statistics have long been inadequate as they chiefly represented production rather than goods moving into consumption. Such industries represent, mainly, raw materials production, not the demand for finished products.

Trade information should, as completely as possible, reveal the stocks on hand held for speculative, as distinct from distributive, purposes. In other words, the normal amount of our national inventory for each important commodity and its expected trend should be estimated as nearly as possible so that variations from this figure will indicate the probable course of the commodity price. Government agencies have, in the past, developed valuable and fairly complete current reports for coal and petroleum, and the work already done along these lines may well serve as a model for other industrial statistics.

In 1922 the Committee on Unemployment appointed by Herbert Hoover, Secretary of Commerce, carefully considered the problem of business cycles. While no very tangible results with respect to the further refinement of forecasting methods were developed, the movement indicated a growing and desirable tendency on the part of government officials to co-operate with leading business men for the stabilization of prosperity.

The federal government, in addition to the further development of scientific forecasting, has directly aided in the reduction of cycles to a more orderly movement by:

1. Regulation of government expenditures for public improvements—the wisdom of which policy was recognized in India and China centuries ago.
2. Regulation of the federal reserve rediscount rate, which in turn exercises a considerable degree of control over all forms of credits and money rates, and thereby over all phases of business activity.
3. Through the advice and counsel of government executives whose knowledge of the economic situation gives their opinions weight.

In the interpretation of economic statistics the following are among the variables to be considered. In interpreting trade and banking statistics it is important to allow for seasonal variations. Thus railroad earnings show a regular periodic variation throughout the year, influenced by crop moving and other seasonal factors. Money rates are frequently higher during crop-moving periods, around dates of tax and interest payment, etc., although this fluctuation has been reduced by the operation of the federal reserve system.

The seasonal element is also important in all phases of consumers' demand, particularly with reference to retail purchases—such as clothing in spring and fall, gifts at Christmas and other holidays, vacation purchases, etc.

An extremely important fact for the present-day executive—if history repeats itself—is that this generation is destined to do business on one of the major declines in prices experienced after each great inflation period. The appreciation of money's purchasing power is, naturally, in reverse ratio to commodity prices. The minor ups-and-downs should be taken advantage of for profit in business buying and selling, but the long swings are important in planning policies, requirements, etc. Few business men can boast of having had extended business experience in both an up-swing and down-swing of major proportions, and therefore nearly every generation must learn the new lessons while these big movements continue to occur.

Business men throughout the country have awakened to the vital importance of changes in commodity prices and business activity and the dangers of inflation and undue speculation have been considerably reduced by a recognition of the far-reaching effect of such variations. Moreover, the great changes brought about by the World War are now in the past, and while they may continue to be a disturbing influence possibly for a generation, yet the trend will become less pronounced as time passes. Prospective changes in prices and in business activity will, however, always remain one of the most important factors in corporation budget-making and determination of operating policy.

Scrap Analysis as a Waste Preventative

By ROBERT G. COOK

Index Number
658.567 Spoilage reduction

IT is recognized that no plant can operate without a certain amount of scrap. The problem, then, is to utilize the scrap to good advantage. This can best be done by: (1) proper analysis and study to ascertain the underlying causes for the spoilage; (2) properly applying the lessons learned in order to reduce, or eliminate altogether, future spoilage from the same or kindred causes.

In the past it has been customary to move condemned material direct from the final inspector to the scrap bins. Usually a report, either daily, weekly, or monthly, would show those interested the volume of scrap and what it consisted of. Periodically, actuated by various causes, a drive would be launched to cut down the volume of rejects. A little more attention would be given to the subject for a while but interest would gradually subside and in a short time conditions would be substantially the same as before.

Spoilage is now, however, attracting more of the attention it deserves and valuable lessons learned through closer analysis of work spoiled are reflected in lower manufacturing costs.

Examination of Condemned Material

Condemned material is held in a space provided for it until it is ready for the scrap bins. It is here examined, not only by those directly responsible for the spoilage but by those charged with the problem of cutting down the volume of scrap.

An examination of this scrap by foremen and others becomes a definite part of the foreman's daily meeting. As the scrap is available for examination at all times, the foremen and others responsible have the opportunity to acquaint themselves with the causes of spoilage and should be able to answer any questions which come up regarding responsibility for it.

This daily examination and discussion of the accumulated spoilage is a very important function in the operation of a manufacturing department. When spoilage occurs, the inspector finally passing on the rejection, notes his reasons on the rejection slip, charging the spoilage directly to an individual or section. His decision, unless further opportunity for examination is given, is noted in the departmental report and a charge is made against the section responsible.

A foreman, examining work thrown out in his department can very often prove that the fault lies further back. At other times, discussion will bring to light faulty tools or processing. Here a jig may be disclosed that is difficult to clear of chips, so that the piece cocks in the jig and is drilled out of location; or a fixture may be of weak construction, springing when the piece is clamped in it; or it may be that a certain cutter should be spiral instead of straight, and so on. In fact, the good arising from a general discussion of causes leading to spoilage and rejection cannot be overestimated. It is here that the work is really analyzed to bring about improvements.

Analysis of New Work

Theoretically, the analysis of new work, the processing, determining the tools necessary, and designing them is done in a conference of the tool engineer, tool designer, process engineer, production man, and the foremen interested in making the parts. Actually, the work is, in many cases, laid out by the processing engineer, passed on to the tool engineer who indicates what tools are believed necessary and then the tools are designed by the tool designers, each one acting more or less independently. Large and intricate pieces are very often taken up in conference and the best possible tooling results. Small pieces, however, are usually considered so much similar to work that has gone before that no special effort is made to improve the tooling, with the result that the tools are, in many cases, merely copies. However, it should be recognized that the savings are not to be made on the large and spectacular pieces alone but on the ordinary work that as a rule forms 90 per cent of the production and is constantly going through the shops. Here, at the rejection table, such pieces get the attention and analysis they deserve.

The time study may be brought into the discussion when the claim is made that the task is too tight and that a man is unable to do the work correctly in the time allotted. Discussion here often leads to a change in processing or tooling whereby not only the quality of the work is raised but production speeded up as well.

Material laid out for examination should not be allowed to lie any longer than necessary. It is either usable or it is not, and must be so judged finally. There is nothing that will kill the interest of a foreman more than being required to search for the later rejections through work that he has previously examined. The enclosure, being kept clear of old work will show what is lost by rejection over a certain period.

The better quality of work resulting from an examination of spoilage can be attributed to one thing—closer analysis of the problems of manufacture affecting the parts, which is the real secret of quality.

Practical Material Salvaging Methods

Prevention and Salvage of Waste at Westinghouse[1]

By C. B. AUEL

Manager, Employees' Service Department, Westinghouse Electric and Mfg. Co.

TO be really effective, a salvaging department must have one or more of its staff thoroughly acquainted with the factory, its products, methods of manufacture and personnel, and also with a wide acquaintance among allied or similar industries. The duties of this department may be lightened to some extent by divorcing from it as much of the routine work of salvaging as possible; as, for example, the handling of raw materials rejected by the inspection department upon arrival at the factory, or the regular sale of scrap turnings, borings, filings, materials broken or otherwise spoiled in course of manufacture, etc. Matters of this kind can very well be handled by the inspection or manufacturing department directly with the purchasing department or supplier. Included in the duties of the salvaging department should be a general inspection of all departments, as well as yards, to see that there are no deviations from rules that have been laid down for waste reclamation.

This will involve the keeping, among other things, of a shop almanac of periodic inspections and "clean-ups" so that the taking of these by the parties upon whom the work devolves will not be overlooked.

Notwithstanding all such precautions, however, it will still be necessary to go even further and get the shop management to call attention from time to time through the mediums of the regular meetings of departmental heads and foremen, or by means of special letters, to the need for more care in the sorting and disposal of scrap and in the prevention of specific wastes. In other words, nothing will stay put for any great length of time, so it is well to pattern somewhat after department stores and run "leaders" at regular intervals covering different matters in turn, including wastes and their prevention.

Savings on Other Companies' By-Products and Obsolete Materials

Once started upon the task of reclamation and salvaging it is surprising to find ofttimes that savings can be made in rather unexpected ways, and a few of these may be cited as follows: A concern, using copper tube terminals for holding electrical wires and cables, found that they could purchase these much more cheaply from a manufacturer of tubing than they could make them, due to the simple reason that the tubing manufacturer made them from short ends of mill length tubing, whereas the concern using them was of necessity compelled to make them from good full-length stock, since that was the only kind obtainable on the market.

Index Number
658.5671 Utilization of waste

Another concern deliberately purchases through the medium of a junkman the supposedly worn-out files of another concern. By cleaning and resharpening these, by means of a steam sand blast, Fig. 1, they are practically all reclaimed. In passing, it may be stated that a file resharpened in this manner will often do better work than when originally purchased, as the scale has then been thoroughly removed. After files have been resharpened several times, they may be further salvaged by being recut by any of the concerns specializing on such work. The use of dilute sulphuric acid (1 oz. acid to 16. oz. water) for resharpening files, is advocated by some. The files are first dry-cleaned by means of a brush, then put into a hot solution of washing soda to cut the grease, scrubbing if necessary, after which they are immersed in the diluted acid for 10 to 14 hr. They are next thoroughly washed in water. The steam sand-blast will, however, be found to be by far the better method, and there is every reason why it should be, because the sand being driven against the file teeth in the proper direction really sharpens them, whereas the acid treatment eats the file more or less all over.

Use of Obsolete Copper Wire

Obsolete copper wire, more particularly of the finer sizes, may sometimes be purchased at a reduced figure and worked over into cables or wire screens; while a draw-bench, an annealing furnace, and a water bath will enable obsolete copper wire of the larger sizes, as well as strap and rods, to be similarly purchased and redrawn into active sizes.

Iron filings are sometimes required in certain manufacturing processes and can usually be obtained readily if the quantity warrants, at a trifling advance over scrap value to cover the cost of handling.

Cardboard boxes and cartons enclosing materials received at a plant may, together with the cardboard backs from used paper pads, be recut to any desired sizes, and again used for the same purpose or for separating single items or layers when packing the regular product for shipment. The remaining pieces may either be shredded and used for packing purposes, or baled, Fig. 2, along with other old paper received as wrappings, and sold. Sometimes, however, such wrapping paper may be used for packaging within the factory at a considerable saving of purchased material.

Reclaimed sugar bags serve well in place of cheesecloth for wiping and dusting purposes, and may be purchased from certain dealers in clean waste and rags. When torn open at the seams and cleaned, they make excellent wiping or dusting cloths, being readily sold to piano manufacturers and high-grade dry-goods stores. Misprint salt and used burlap bags may be purchased at very low figures, and used for the shipment of small orders to customers, and, if confined to orders within the factory itself, can be used over and over again. In either case, their cost compares favorably with other methods of packing.

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[1] Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION for June 1924, p. 669; July 1924, p. 65.

Incoming wood boxes and crates, if opened with a little care, can be made over into smaller standard-size boxes and re-used for outgoing shipments or for tote boxes within the factory. Where this was not practicable, one concern arranged with a couple of employees to scavenge the factory, gathering up all old boxes, crates, and lumber which were taken to a small shack in the yards. The shack was equipped with a power saw and a hatchet. The boxes were rather carefully knocked apart, the pieces cut to length, then split, put into a circular holder, tied with a piece of hemp, after which the tied bundle was taken to a kettle of melted rosin near-by and one end dipped. These bundles were finally sold as firewood. All small ends were burned under a boiler. Heavy pieces of wood, such as skids, etc., have also been used for the paving of factory floors, being first cut to size and then allowed to soak in creosote before using. Occasionally, though not often, old lumber may be sold directly to the consumer for firewood, but it is more usual to see a sign bearing the legend, "Firewood given away," when it is expected the party desiring it will furnish the haulage.

Miscellaneous Savings

There is considerable wastage of materials constantly going on in a factory in ways which cannot be prevented, except by drawing the attention of employees to the matter in some more or less spectacular manner which they will understand. During the war, one concern adopted a novel scheme for bringing these small but constant wastes forcibly before their employees by means of a display on a battery-operated truck, of items of this kind collected in the course of a day, as well as of food thrown away by those employees who brought their lunches from home. The wasted food and materials were arranged in two piles on the platform of the truck, and over both was placed a sign bearing the legend: "Wasted—food brought from your own homes —materials belonging to the company". The truck then slowly made its way up and down the various aisles of the factory (Fig. 3). This same scheme has also been followed in calling the attention of employees to dangerous shop practices in the continued use of mushroom headed tools, frayed rope, slings, sledges with cracked handles, etc., such items being hung on both sides of a vertical board mounted on the truck.

Cleanliness, orderliness, and neatness in a factory, no matter how much emphasized, cannot be overdone. Time expended originally in laying out working spaces, aisles, and storerooms, and the subsequent expenditure of labor in maintenance of these items will prove to be an economy of immeasurable value, the far-reaching effects of which can more nearly be appreciated perhaps by those who have experienced the reverse conditions and emerged from them. Aside from the direct returns in labor- and material-saving and of economy of space, etc., the morale of the entire personnel will be favorably affected. Figs. 4 and 5 illustrate the modern trend in cleanliness, orderliness, and neatness both inside and outside of a factory, attention being particularly drawn to the space between uprights, usually wasted, but which has been utilized as storage racks for armatures.

A daily patrol should be made of all steam, water, gas, and air lines, and air hose and tools for leaks; of light and power lines for unnecessary burning of lights, gas, or idle running motors, etc. Occasionally a patrol of this kind will discover the fact that due to the rearrangement or removal of one or more shop tools a motor driving a section of line shaft is too large and should be replaced by a smaller one.

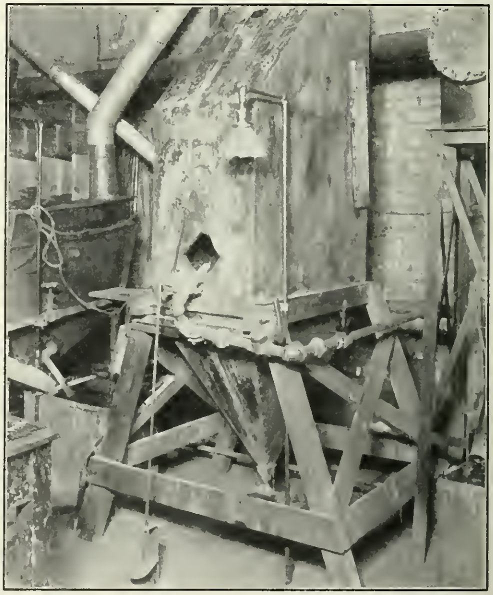


FIG. 1 STEAM SAND BLAST USED IN SALVAGING WORN OUT FILES, ETC.

As factories grow, processes of one kind and another are introduced which may require steam, hot water, or heat for their operations; and it may sometimes be found that savings may be effected by a further use of the exhausts from these items; for example, the condensed steam or hot water from one process might be trapped and returned to the boiler-room as feed water, thus saving both heat and water. The heat escaping into the chimney from another process might be used to operate a hot-water heating system, much after the manner of an economizer in a boiler stack, and so on.

Proper segregation of scrap can be effected usually by having scrap receptacles placed about the plant in sufficient numbers, each properly marked for the kind of scrap to be placed in it. As soon as the receptacles are filled, they should be replaced by empties and the full ones forwarded to the scrap department. All receptacles should bear a tag or mark, showing the department from which they came, so that, in the event of any mixed scrap being sent out, the matter can be promptly traced back to the department at fault. Unused or excess stock should be credited back to stores or suitably located for future use.

Occasionally the work passing through a department lends itself to the establishment of a bonus for waste prevention. For example, when the proportion of scrap to a given number of pieces completed can be determined, then a smaller proportion of scrap would entitle the workman to a bonus. Similarly, bonuses may be worked out for a reduction in average breakage when unloading car lots of breakable material. A bonus may also be applied to advantage for the drivers of battery-operated industrial trucks, depending upon the loads carried with deductions for accidents. This involves more care in the handling of such trucks, thus keeping them in service longer with consequent saving in maintenance.

Examining and testing the product operation by operation, is undoubtedly the best method of inspection to follow where practicable. The extra labor expense in so doing will usually be more than offset by the saving made in direct labor and by lessened defective work. A method of accomplishing this without adding to the inspection force has been evolved in connection with a system of wage payment by group working. Briefly, an order for a certain number of pieces, each requiring several operations, is issued to a group of workers, who may be allowed a given number of hours in which to perform the work. Any saving in time is divided between the company and the men; while if more than the allowed time is taken, because of work requiring to be done over, or if any material is spoiled, each man is paid but his regular hourly rate. In one concern where this plan has been tried out over a period of years it has proved very successful, marked savings having been made both in labor and material. For a scheme of this kind to be effective, there must be an opportunity for the men as a group to earn more than when previously working individually.

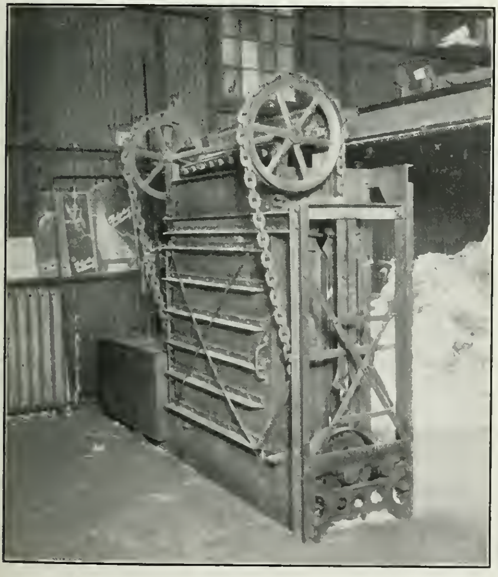


Fig. 2 Baling Machine for Use in Salvaging Cardboard, Paper, Etc.

Cutting oils are reclaimed quite generally in screw machine or other departments where largely used. Centrifugal separators are provided for removing the oil from the finished materials, and this excess oil is then filtered, perhaps further treated and used over again. Sometimes a pipe system connects each individual machine in a department with a centrally located system of tanks for the supply of oil and for its subsequent treatment. However, little thought is given in the majority of factories to the isolated machines scattered throughout other departments; and, in consequence, the oil is used over and over again, becoming more and more loaded with foreign matter of all kinds, until finally, it is no longer fit for machining purposes, and is then thrown away. Not only does it rapidly deteriorate under these conditions, but it also becomes unfit to use from a hygienic standpoint, so that there are several reasons for its reclamation. Equipping a laborer with a truck, pail, tank, and suction pump, and having him patrol a route laid out to include all isolated machines at regular intervals will not only result in a direct saving of oils, since the oil collected can be taken to the central filtering plant and cleaned, but will probably prevent occasional cases of infection, a single one of which will of itself represent no small item of expense. When the oil has served its purpose and is spent, it may still be used "as is" or mixed with other oil and used for the swabbing of dies or else thrown in with the fuel oil, if any is used.

A survey of the entire factory from the standpoint of the cutting oils required will sometimes indicate where satisfactory economies can be made; as, for example, the substitution of sulphur or other mineral oils for the higher-priced animal oils.

The use of white waste for cleaning or wiping purposes in factories is almost a thing of the past, having been largely replaced by colored waste, by "noils" or wiping cloths, by white rags and, at the present time, by near-white rags. Rags serve the purpose almost as well as waste and have the added advantage that even if brought into contact with metal borings or turnings these can be shaken off, the rags cleaned by a regular process, and used again. However, care should be taken at all times not to allow soiled waste or rags to lie around or accumulate even over a day, especially if they have become saturated with oil, more so if with a vegetable oil, as fires are likely to occur, due to spontaneous combustion. They should be burned under a boiler.

Worn or greasy belting should never be thrown away but should be sent to concerns who make a regular practice of restoring it to serviceable condition. However, if this plan is not feasible, it may be readily restored at the factory by allowing it to soak for about 12 hr. in gasoline, then removing and drying, after which it should be given a good rubbing with a suitable belt dressing. Worn spots should be cut out before the belting is returned to service. If the belt does not warrant being put back to work in the place from which it was originally taken, it may be put into lighter service. The pieces cut out may be used for brake linings, straps, sometimes as hand leathers, or they may be sold to manufacturers of boot heels, carbonizing materials, leather findings for polishing operations, etc.

The use of a large magnifying glass, such as used for looking at stereoptican views, will sometimes prove most serviceable in preventing defective work, by sufficiently enlarging small pieces to enable mistakes to be avoided by operators of various kinds of machines.

Hand soap stored away and given time to dry properly will prove much more economical than if used as soon as received from the manufacturer; and, if cut into small pieces before being distributed will generally be found to be cheaper than any other form of soap.

A most economical form of envelope for use exclusively within a factory or office may be made from the usual type of manilla envelope with horizontal lines ruled entirely over the front, a single line being taken each time for the name of the party addressed and his location.

Broken and worn out emery wheels and foundry crucibles can usually be sold to the suppliers, although the pieces of emery wheels can be used to advantage in redressing polishing wheels.

Sawdust, if clean and homogeneous, is one of the best extinguishers for small oil or varnish fires. It can be used for this purpose alone or mixed with soda (3 bu. sawdust to 10 lb. carbonate of soda). It is also useful for polishing purposes in tumbling barrels and as a drier for small wet articles, which are buried in it. Wood ashes, if from hardwood, have a salvage value as a fertilizer on account of the potash content.

For the reclaiming of broken or defective steel and cast iron castings the electric arc or the oxyacetylene welding outfit is invaluable. Such outfits may be used for cutting materials, ofttimes with far less waste of material and in considerably less time than when done with a machine tool; for example, an oxyacetylene pantograph torch used for the cutting of blanking dies in a certain factory has replaced five slotters, while electric arc generators are used in some foundries to remove risers and sink heads from steel castings, displacing the usual cutting-off saws and saving not only the time required to set up the piece, but time in the doing of the work as well. Metal scrap, difficult to handle owing to its length or shape, can sometimes be cut into smaller pieces by one of these methods when it may then have a salvage value.

Small hydrogen welding outfits will prove useful in the repair of lead battery lugs, terminals, and the like. The torch is of the simplest form, and the necessary hydrogen can quickly be made by placing in a covered jar—to which is attached a hose leading to the torch—some pieces of zinc, and pouring over them a quantity of dilute sulphuric acid. A slight pressure of air is also required to operate the torch so that it would be advisable to obtain details from some one who has had experience before putting a scheme of this kind into effect. Care is necessary, as hydrogen is explosive.

Automatic devices for controlling temperatures, volumes, and quantities should be largely employed as their use will prevent constant losses which in the aggregate will total large amounts. A more satisfactory product will also be obtained by their use; for example, attempting to pour babbitt bearings with only hand control over the temperature of the molten metal, will result in a lack of uniformity in product.

For convenience in handling as well as for the avoidance of waste, carboys, barrels, and casks containing liquids, are sometimes fitted with trunnions and mounted on supports so that they always maintain an upright position and require tilting by hand in order to pour their contents into other containers.

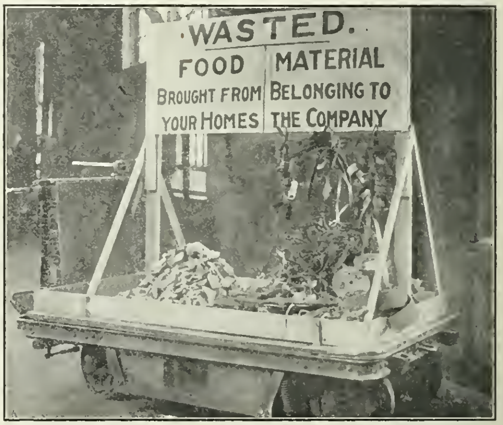


FIG. 3 METHOD USED BY WESTINGHOUSE TO IMPRESS ON EMPLOYEES MAGNITUDE OF WASTE

A flux for cleaning and deoxidizing solders and babbits consists of:

Hard-wood sawdust	50	Per Cent
Rosin	25	" "
Wheat middlings	15	" "
Sal ammoniac	10	" "

This should be thrown over the top of the molten metal, covering it. As some smoke is given off, it is used to best advantage, when the solder and babbitt pots are properly hooded.

Dipping, spraying, or painting by passing between saturated felt rolls should be substituted when at all practicable, in preference to painting by hand, as the work is not only done in far less time, but is more uniform, and requires less paint. If the dipping or roll process is employed, hooks or drip boards can be arranged to permit the paint to drain back into the dip tank. When hand painting is done by unskilled help, great deterioration and waste of brushes occurs. This may be decreased by having as much of the paint as possible wiped off the brushes at the end of the day, and then place them in water over night or until the next job is to be undertaken. Wire wheel brushes may sometimes be used to great advantage for wiping materials clean and removing excess metal after dipping in solder.

A roll of roofing paper will cover a worn strip of linoleum along a hall and will avoid the necessity of replacing the latter, as the paper is tough and wears well.

Washers may be punched from scrap sheet rubber, asbestos, fiber, steel, brass, copper, mica, paper, leather, etc. Rubber-covered cable and wire scrap may be salvaged either "as is" or by removing the insulation by a hand tool. Or it may be salvaged for the copper only, by burning off the rubber insulation.

Changing the temper of material from hard to soft by annealing or reversing the process will sometimes be the means of reclaiming otherwise obsolete material.

Lumber, as purchased, is largely undried and should be allowed to weather or dry out before using if shrinkage, cracks, etc., are to be avoided. This drying may be done in the open without rotting, if it is properly covered and piled so as to permit a free circulation of air between spaces. Considerable waste of lumber may be avoided by proper care in purchasing with respect to quality or grade, and also with respect to finish and thickness. For example, if 2 in. lumber is wanted for pattern-making, it may be a good plan to buy it in the rough (unsurfaced) specifying that stock must be full to size, straight, etc. The pattern-maker can then surface a very large part of it to give 2 in. when finished. If it were to be purchased as 2 in. (8/4) surfaced, instead of in the rough, it would generally be cut by the mill from 2½ in. (10/4) rough stock, this being the nearest size, and the purchaser would pay for the larger material.

FIG. 4 ILLUSTRATING MODERN TREND FOR NEATNESS AND CLEANLINESS IN FACTORY YARDS

However, if 2 in. lumber is wanted for the general run of carpentering work, where exact thickness is not so important, it should preferably be bought from the mill surfaced on both sides, as money will actually be saved in so doing over the same quantity purchased in the rough. The reason for this is that the lumber, being cut from 2 in. rough stuff (not 2½ in.), will be less than 2 in. when finished, the total weight will be less and the saving in freight rates per hundred pounds more than sufficient to offset the extra cost of surfacing at the mill. If a size less than 1 in. in thickness is wanted, say ½ in., it is advisable to order it to be cut from 1¼ in. (5/4) rough stock resawed and surfaced two sides to ½ in., otherwise it would be cut from 1 in. rough stuff, requiring almost twice the amount of material.

Spigots for both hot and cold water should be of the self-closing type. Not only will they save water at all times, but they will avoid the occasional flooding of a floor, which may happen with the other type.

The life of wood floors, on which hand-trucking is heavy and more or less continuous, can be lengthened by laying two strips of sheet iron, about 12 in. wide, parallel to each other, and about 18 in. apart so that the wheels of the trucks may run on them instead of on the floor.

Brooms and brushes, when they have become worn, may have their lives extended by being trimmed and used for rough work; as, for example, an old broom or brush will clear away the chips from the table of a boring mill as readily as a new one.

There has been developed recently a process of saving worn parts; that is, restoring them to their original dimensions by electro-deposition. Such parts as bolts, pins, etc., have actually been reclaimed and put back into service by this method, although it is perhaps too early to state anything as to the wearing properties compared with the original material.

Rust is one of the greatest causes of waste in the products of many of the industries and accordingly means for its prevention continue to be eagerly sought. While there are many methods of rust prevention in use, the great majority of them produce results which are either not sufficiently lasting or else are unsuited for universal application. Hot galvanizing still holds its place as one of the best permanent methods to employ, but the resulting coating is rather rough, and, at times, too thick to permit its use, especially where fits are involved as with bolts and nuts. The centrifugal process, which has lately been developed, would seem to offer a means of overcoming this difficulty.

Various other methods have been tried, from simple greasing, lacquering, or painting, to the more complicated scheme of hot metal spraying, sherardizing (zincing) or the several forms of electroplating in more or less common use, nickel, copper, brass, cold galvanizing, to which list has now been added cadmium plating. This last process is different from the other plating process in that, after the cadmium has been deposited, it is then necessary to heat-treat the article at a high heat when the cadmium tends to alloy with the metal surface on which it has been deposited.

The electrostatic precipitation process has come into commercial use within recent years for the recovery of sulphuric acid and of certain dusts, including lead, copper, antimony, arsenic, sulphur and potash from the fumes given off in heat treatments (smelting, roasting, and burning) of ore and stones, such as calcium carbide, copper, lead and limestone. The same process may also be employed for the precipitation of smoke.

Adequate lighting, both natural and artificial, involving not only the original equipment but subsequent maintenance, operation, and rearrangement of it from time to time as occasion demands, would seem to be one of the greatest waste preventive measures which could be installed in any factory; and a concern, which is willing to and does pay thousands of dollars for tool equipment, should be exceedingly careful not to defeat the purpose of such an expenditure by a parsimonious outlay for lighting equipment. In order to use lighting equipment to best advantage the cleaning of windows, roof lights, reflectors and globes should be placed on a systematic basis, and one or more men or groups of men should be assigned regularly to this work. Sometimes difficulty is encountered in removing the deposit which accumulates on roof glass, but a weak solution of oxalic acid (1 part acid to 16 parts water) has been found to be very efficacious.

Handling and Reclaiming of Small Tools

Chisels, hack and band saw blades, saws, reamers, air hammers, drills, chucks, gages, etc., may be readily reclaimed, and, when the volume warrants, one or more special men should be detailed to look after such work.

A waste involving every conceivable item of time, labor, material, equipment, floor space, etc., occurs when a concern attempts to make all of the items entering into its finished product, when perhaps it could purchase some of them to better advantage.

Sorting Department

All rejected materials, except perhaps material rejected when received from outside suppliers, should be forwarded to a sorting department, and, in the case of large concerns, to a special building, where they can be gone over and final disposition made. It is here that the results of failure on the part of the manufacturing department to observe rules laid down in the matter of keeping scrap separate and of tagging materials, etc., will become apparent.

An inspection of scrap material on display will sometimes show what appears to be an excessive amount of some particular kind or piece and a further investigation into the methods of manufacture, machining, handling, or design may indicate where a change may be made and the amount of scrap reduced.

A department or building of this kind should be well-equipped with transporting and lifting devices, including broad- and narrow-gage tracks and cars, traveling cranes, lifting magnets, scales, battery and hand-trucks, steel drums, bins, barrels, boxes, magnetic separators, cutting machines, baling presses, reduction furnaces, benches, vises, etc., and there should be a storage place conveniently situated in the open and provided with bins for the temporary storage of sorted materials and a skull-cracker for reducing the larger items to more convenient size. Materials affected by the weather are stored within the building, other materials outside. All materials which it is decided to sell, should be held until the market appears favorable. Occasionally scrap may be made in such quantities or be so bulky and awkward to handle that it is disposed of where made. This is true with machining departments equipped with heavy machine tools where enough turnings and borings are made to fill a number of large-sized containers in the course of a day or two, which can then be shipped directly into a waiting car. Sheet steel scrap is similarly handled, being fed into the baling press, then compressed into cakes of about 400 lb., and then loaded directly into car. Such an operation readily pays for itself, as the material is very compact and comparatively easily handled, and has a higher salvage value than loose material. A number of other materials may be similarly treated to advantage—paper, rags, wire, etc.

Briquetting, or molding into brick form, has already been successfully attempted with a number of waste products, such as coal dust, ashes, saw dust, ore dust, and metal borings and turnings. Clay bricks made from ore slime residue are well adapted for building purposes.

The skimmings, droppings, and dross from furnaces, crucibles, pots and tanks usually have salvage values, as have the various furnace slags, and even the residue or ash from the incinerators and the various chimney deposits may warrant analyses to determine if they, too, have salvage values.

The scum from a hot galvanizing tank, known as sal-ammoniac skimmings, has a ready market as the ammonia and zinc contents can be reclaimed, or it can be refined and used as a soldering acid. The dross can be reclaimed by ladling it from the bottom of the tank by means of a perforated ladle through which the zinc drains back into the tank leaving the dross in the ladle. This dross is then placed with tumbling balls in a rotating drum to which heat is applied. The dross is gradually ground down to a fine size when it can then be used in the sherardizing (zincing) process.

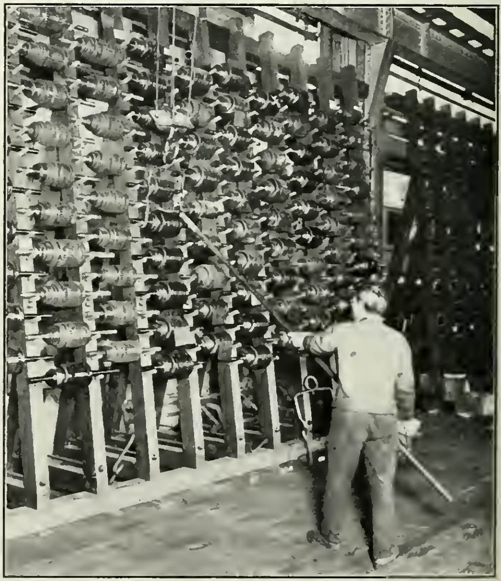


FIG. 5 ILLUSTRATING MODERN TREND FOR ORDERLINESS IN FACTORIES

In reclaiming some of the metals, certain concerns throw the scrap right back into the pots or crucibles. This is a serious mistake unless the scrap is clean.

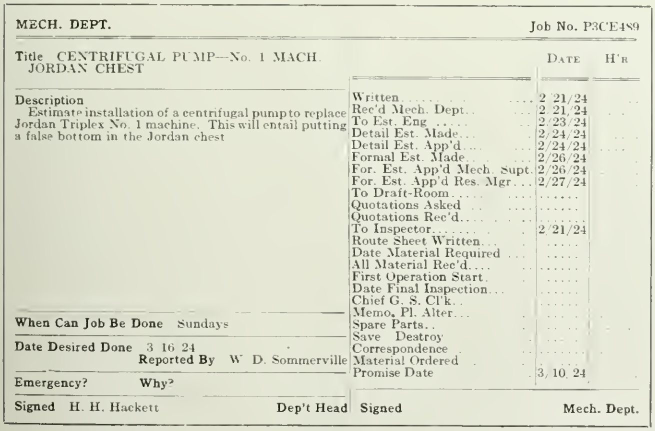
Managing Maintenance Work with Economy

Planning, Routing, and Use of Standard Times—I

By THEODORE CLARK

Mechanical Superintendent, Eastern Manufacturing Company

THE idea of applying the methods of Scientific Management to repair and construction work is not entirely new. There have been in operation at a few plants for several years more or less complete systems of analyzing the repair work to be done before the work is started: ordering the necessary materials; routing and scheduling the various operations; and writing detailed instructions as to how the workman should proceed. These developments, in so far as they have gone, have been very similar in general scheme to the orthodox application of Dr. Taylor's "Principles of Scientific Management" to any manufacturing proposition. A good deal of progress has also been made by certain firms in the application of exact time-study analysis to building and construction work, and in the use of the resulting standard times as a basis for payment of bonuses for the work done.



MECH. DEPT.	**Job No.** P3CE489

Title CENTRIFUGAL PUMP—No. 1 MACH. JORDAN CHEST

Description
Estimate installation of a centrifugal pump to replace Jordan Triplex No. 1 machine. This will entail putting a false bottom in the Jordan chest

When Can Job Be Done Sundays

Date Desired Done 3 16 24

Reported By W D. Sommerville

Emergency? **Why?**

Signed H. H. Hackett **Dep't Head**

	DATE	H'R
Written	2 21/24	
Rec'd Mech. Dept.	2 21/24	
To Est. Eng	2/23/24	
Detail Est. Made	2/24/24	
Detail Est. App'd	2/24/24	
Formal Est. Made	2/26/24	
For. Est. App'd Mech. Supt.	2/26/24	
For. Est. App'd Res. Mgr.	2/27/24	
To Draft-Room		
Quotations Asked		
Quotations Rec'd		
To Inspector	2/21/24	
Route Sheet Written		
Date Material Required		
All Material Rec'd		
First Operation Start		
Date Final Inspection		
Chief G. S. Cl'k.		
Memo. Pl. Alter.		
Spare Parts		
Save Destroy		
Correspondence		
Material Ordered		
Promise Date	3/10. 24	

Signed **Mech. Dept.**

FIG. 1 USED ON ALL REQUESTS FOR WORK TO MACHINE DEPARTMENT

Finally, a few attempts have been made toward the payment of bonuses on strictly repair work. These bonuses, however, have generally been of the Rowan or Halsey type where a certain length of time in which the repair should be made is set by the foreman, basing his judgment on past experience, and if the job is done in less than this estimated time a percentage of the time saved is paid to the workman. While such a scheme is undoubtedly workable, its weakness—uncertainty, especially on non-repetitive work—is obvious, and the chance for serious disagreement between foreman and men, and between foreman and company over the times allowed is considerable. Further, it is generally not possible to obtain as large a "pick up" in time saved where the time allowed is estimated, as where the time allowed is accurately figured from predetermined standard operation times.

Index Number
658.58 Maintenance and repair
658.5 Shop Management

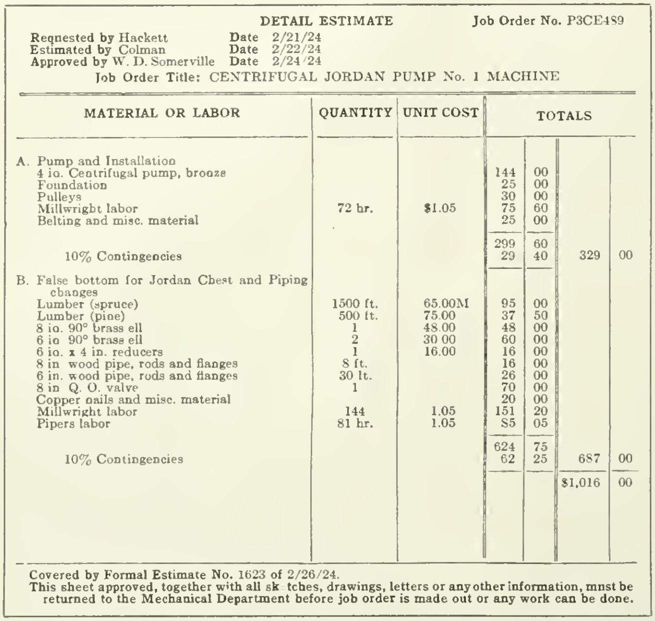
It is the purpose of this paper to describe what is believed to be a new development: the application to a construction and maintenance department of a manufacturing plant of a complete system of planning and routing work, *and the payment of bonuses based on times determined by accurate time study.*

Description of Plant

A brief description of the plant in which this system is used is necessary to acquaint the reader with the quantity and variety of the work. The plant consists of an 80-ton pulp mill manufacturing bleached sulphite pulp, and a 60-ton paper mill having a complete finishing room, equipped with the necessary machinery for turning out fine writing papers. As auxiliaries to the above, there are an 8-ton electrotype bleach plant, which supplies bleach to the pulp mill (marketing the by-product caustic), a 2500 (rated) hp. boiler plant to furnish process steam, and a box shop with a capacity of 8000 bd. ft. of finished cases per day.

For the past three years the repair and construction crews have arranged from 50 to 100 men, the number varying with the amount of alteration and construction work in progress. Owing to the constant necessity for introducing new processes, rebuilding old parts of the mill and construction additions, the volume of non-repair work has been considerable, averaging several hundred thousand dollars per year. Consequently, the scheme to be described and the organization for handling it have been rather more complete than they would have been had all construction work been handled by an outside firm of contracting engineers.

This article will deal primarily with the methods of determining and using the standard times for repair work, but in order that the reader may understand the scheme in its entirety the following brief explanation of the general routine is given.



DETAIL ESTIMATE Job Order No. P3CE489

Requested by Hackett Date 2/21/24
Estimated by Colman Date 2/22/24
Approved by W. D. Somerville Date 2/24/24
Job Order Title: CENTRIFUGAL JORDAN PUMP No. 1 MACHINE

MATERIAL OR LABOR	QUANTITY	UNIT COST	TOTALS			
A. Pump and Installation						
4 in. Centrifugal pump, bronze			144	00		
Foundation			25	00		
Pulleys			30	00		
Millwright labor	72 hr.	$1.05	75	60		
Belting and misc. material			25	00		
			299	60		
10% Contingencies			29	40	329	00
B. False bottom for Jordan Chest and Piping changes						
Lumber (spruce)	1500 ft.	65.00M	95	00		
Lumber (pine)	500 ft.	75.00	37	50		
8 in. 90° brass ell	1	48.00	48	00		
6 in 90° brass ell	2	30 00	60	00		
6 in. x 4 in. reducers	1	16.00	16	00		
8 in wood pipe, rods and flanges	8 ft.		16	00		
6 in. wood pipe, rods and flanges	30 ft.		26	00		
8 in Q. O. valve	1		70	00		
Copper nails and misc. material			20	00		
Millwright labor	144	1.05	151	20		
Pipers labor	81 hr.	1.05	85	05		
			624	75		
10% Contingencies			62	25	687	00
					$1,016	00

Covered by Formal Estimate No. 1623 of 2/26/24.
This sheet approved, together with all sketches, drawings, letters or any other information, must be returned to the Mechanical Department before job order is made out or any work can be done.

FIG. 2 PRELIMINARY ESTIMATE SHEET

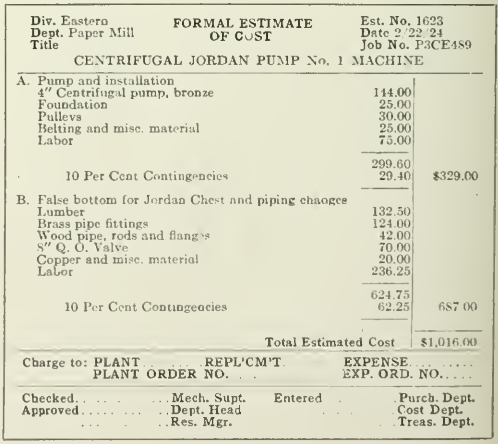
Prepared by an estimator for jobs costing over $1000.

The jobs to be done may be divided into three general categories: major jobs, those which it is anticipated will cost over $100; minor jobs; and emergency jobs. Work is considered to be of an emergency nature if production is being interfered with until such time as the work can be completed.

In so far as the method of handling the planning is concerned, it is not necessary to differentiate between repair and construction work, the routine being substantially the same for handling each. In the case of all but emergency jobs, the job is started by sending to the mechanical department a Job Order Request (Fig. 1). These requests originate with the department foreman who lays his needs before his immediate superior. These job order requests are made out in triplicate, one copy being retained by the originator of the job, the other two being sent to the mechanical department. After the job has been planned and material has been received a copy of the job order request is returned to the originator of the job with a job number and promise date for completion of the work. This has proved a valuable feature, as the promise date gives the man originating the job an opportunity to know when the work will be completed and to plan accordingly, or, if necessary, to insist on earlier completion.

When the job order request is received by the mechanical department it is immediately assigned to an inspector who consults with the originator of the job to determine exactly what is wanted. If, in the inspector's judgment, the job will cost over $100, he arranges to have such preliminary engineering layout of the job made as is necessary to allow making an accurate estimate of its cost. This estimate is made by a trained estimating engineer. When this Preliminary Estimate (Fig. 2) has been prepared, it is submitted to the department head originating the job. If he approves the estimate a more condensed form known as the Formal Estimate (Fig. 3) and a condensed reference card designated as a Contemplated Improvement Card (Fig. 4) are made out. These are submitted first to the mechanical superintendent for checking as to method and general accuracy, second to the superintendent of the department requesting the work, and finally, to the resident manager for approval.

After the job order has been formally approved, a more complete engineering layout is made (if necessary), and the order returned to the inspector, generally with a fairly complete material specification made out by the drafting-room. The inspector then proceeds to plan the job in detail, writing any necessary additional material specifications, detailed instructions for each operation of the various mechanical department crews and instruction cards (Figs. 5-6) showing the allowed time for the operation. The detailed instructions for each operation contain 10 to 100 words and give a concise exposition of what is to be done. The instruction card is simply a list of the unit operations and unit times allowed for these operations. After this work has been completed by the inspector the job order folder is passed to the material



Div. Eastern
Dept. Paper Mill
Title

FORMAL ESTIMATE OF COST

Est. No. 1623
Date 2/22/24
Job No. P3CE489

CENTRIFUGAL JORDAN PUMP No. 1 MACHINE

A. Pump and installation		
4″ Centrifugal pump, bronze	144.00	
Foundation	25.00	
Pulleys	30.00	
Belting and misc. material	25.00	
Labor	75.00	
	299.60	
10 Per Cent Contingencies	29.40	$329.00
B. False bottom for Jordan Chest and piping changes		
Lumber	132.50	
Brass pipe fittings	124.00	
Wood pipe, rods and flanges	42.00	
8″ Q. O. Valve	70.00	
Copper and misc. material	20.00	
Labor	236.25	
	624.75	
10 Per Cent Contingencies	62.25	687 00
Total Estimated Cost		$1,016.00

Charge to: PLANT .... REPL'CM'T. EXPENSE..........
PLANT ORDER NO. . . EXP. ORD. NO.....

Checked............Mech. Supt. Entered ....Purch. Dept.
Approved............Dept. Head ....Cost Dept.
............Res. Mgr. ....Treas. Dept.

FIG. 3 FORMAL ESTIMATE SHEET

Prepared if preliminary estimate is approved, and becomes authority for doing the work.

clerk who requisitions (Fig. 7) or apportions from the general store all necessary materials to do the job. If all materials are available in the general store at the plant, the job order folder leaves the material clerk without delay and is passed to the routing stenographer who types time tickets (Fig. 8) and instructions for the various operations. After this work has been done, the folder is passed to the order of work clerk who proceeds with the execution of the job.

If all materials are not available, the material clerk holds the job folder until all ordered materials have been received or until such time, in his opinion, as the job may be started to advantage with the then available materials.

Eastern **CONTEMPLATED IMPROVEMENT** Paper Mill
CENTRIFUGAL JORDAN PUMP No. 1 MACHINE

PROPOSED—To replace the present triplex geared plunger pump, pumping stock to the Jordan, with a bronze 4" standard centrifugal pump.

ADVANTAGE—1. Will replace the old pump which is inefficient and worn beyond repair, due to its continuous service of many years.
2. Will provide a centrifugal pump that has proved by trial to handle stock very economically and efficiently. The pump is of our own make and as all parts are carried in stores, it can be easily repaired.
3. Will decrease maintenance costs and save many shut downs for repairs.

EST'D COST—$1,016.00. See formal estimate of cost No. 1623.
EST'D SAVING—$210.
GROSS EARNING—21%.
NET EARNING—5%—**DEDUCTING** 6% **INT. AND** 10% **DEPQ.**
DISCUSSED— **APPROVED**—

FIG. 4 CONTEMPLATED IMPROVEMENT CARD

The order of work clerk removes the tickets, instructions, and instruction cards from the folder along with issues for stock materials made out by the material man, and move tickets (Fig. 9), and posts them in their proper sequence ahead of the various crews. The move ticket scheme presents nothing new and hence has not been described in detail. In general it comprises the usual scheme of having, in so far as possible, all materials moved to the job by low-priced men rather than by mechanics. In the case of small articles which might be lost by moving directly to the job, these are placed in a rack provided for the purpose operating in conjunction with the toolroom. A copy of these tickets is attached to the mechanic's instruction card so that he can see at a glance where his materials for the job are located. On receipt of these various papers the workman, after collecting materials held for the particular operation he is on, and any special tools specified on the instruction card, proceeds with the execution of the job. A summary of the steps involved in routing a job order through the planning operations is given in Fig. 10.

The work of the foreman is highly functionalized in that, so far as possible, he is not required to devote much of his time to anything except the execution of the jobs. While the inspectors, material clerk, and order of work clerk now are all quite expert at their work it is neither possible nor wise to dispense altogether with the foreman's knowledge of the work and equipment. Hence a close contact on much of the planning is maintained with the man who is to be held responsible for execution of the job. This applies even to the order of work clerk who tempers the chronological arrangement of the work ahead of each crew with advice from the foreman and production man (head of planning department) as to the sequence to be followed to secure best results. Even with these demands on the foreman's time, however, he is able to devote most of his energies to the actual execution of the work.

No attempt is made to post tickets ahead of individual men in the crews. Rather, all tickets for a given class of artisan are held ahead of that class as a whole. The scheme of posting tickets ahead of individual crews was early discarded as being unable to meet the constantly changing conditions surrounding the various operations going to make up maintenance jobs.

It is entirely feasible with straight manufacturing work to write an instruction card accurate in every detail, and to insist that the man on the job follow exactly these instructions. This state of affairs, however, does not obtain with mill maintenance work where conditions often do not exist "under the cover"

Instruction Card for Operation **Symbol (C)**

Sheets, Sheet No.	**Classification of Crew** MR-2 MRH	**Order No.** U4 BH 500 No. 1

1 2
TAKE OUT SCREEN SHAFT IN WET ROOM—ONE WITH CLUTCH ON IT—REMOVE CLUTCH FROM SHAFT AND MOVE HUB TO MACHINE SHOP

ITEM	DETAILED INSTRUCTIONS	ELEMENT TIME PER UNIT		TIME FOR ENTIRE LOT	
	1. Change ticket and read instructions			11	25
	2. Get chain falls from tool room and go to job			4	75
	3. Rig up 2 chain falls			6	00
	4. Take off caps			16	64
	(a) Remove nuts	13	44		
	(b) Lift off caps	3	20		
	5. Take off shipper			5	46
	(a) Remove nuts	3	86		
	(b) Lift off shipper	1	60		
	6. Take off hood			6	40
	7. Lift out shaft			9	40
	(a) Hook on	1	00		
	(b) Raise shaft out	8	40		
	8. Remove clutch			17	50
	(a) Drive off hub	6	00		
	(b) Drive off clutch	9	00		
	(c) Hook on with fall	1	00		
	(d) Lower on to truck	1	50		
	9. Take to machine shop and tag			1	75
	10. Return to mechanical office				40
				79	55
	Tools Allowances— 2% Sharpen tools 10% Fatigue 25% Contingencies			31	82
	Wrenches Hammer Pinch bar Chain falls			111	37
	Time taken 2.23 Time allowed 2.23				

If operation cannot be done according to these instructions, notify foreman or Mechanical Dept. office.		**Time Allowed**		**Hours**
Return this card to office with completed job ticket	**Signed** W. H. Pooler	**Month** 4	**Day** 22	**Year** 20

FIG. 5 INSPECTION CARD

Showing detail operations to be performed, detail times allowed for performance, and total time allowed for job.

as they appeared to the inspector when the work was planned. Hence the instructions handed the men are considered more as a guide than as an instruction on how to proceed. The man, in effect, is told: "Here is a job to do; the end sought is thus and so; the following instruction outlines what appears to be the best way to proceed. If, however, after you get your work started, you can, with your foreman's approval, devise a better means, you are free to proceed along those lines, but, if you get off on the wrong tack by devising your own methods and lose your bonus as a result, don't try to get extra time allowances to cover your mistakes because you won't succeed".

This policy has worked very well in practice. The men are on their toes and continually trying to devise ways and means of "making a killing" on their jobs, but experience has taught them not to venture over their depth. The ingenuity resulting with this incentive has been most gratifying both to the men through high earnings and to the company through quick and economical execution of the work. The impression must not be gained from this description, however, that the planning of the method of execution of repair work by the inspectors is superficial or inaccurate, generally, for such is not the case. It is a fact, though, that hardly a job is done by the more competent men in the crew wherein they do not at some point improve on the method laid out for them.

EASTERN MANUFACTURING CO.
Requisition
No. 479M
To PURCHASING DEPT. Feb. 29, 1924
The following Material is needed March 1

	QUANTITY ON HAND	QUANTITY WANTED	MATERIAL	ORDER OF TO BE USED FOR	PURCHASE ORDER No.
		1	Bronze Impellor Pattern 416 for 4" Centrifugal Pump		21609

....19
Approved
.. ..

FIG. 7 MATERIAL REQUISITION

Used by material clerk for requisitioning materials from general stores or purchasing department.

Instruction Card for Operation **Symbol** (AN-P3-A)

Sheets, Sheet No.	**Classification of Crew** MR-2	**Order No.** P3 BH 678 No. 1

RENEW DRIVE PINION AND DRYER GEAR No. 1 PAPER MACHINE

ITEM	DETAILED INSTRUCTIONS	ELEMENT TIME PER UNIT		TIME FOR ENTIRE LOT	
	1. Change ticket and read instructions			11	25
	2. Get chain falls and go to job			3	00
	3. Study job			30	00
	4. Hang hoists			12	00
	5. Remove pinion			78	04
	(a) Remove cap bolts 12 x 1.04	12	48		
	(b) Remove caps	1	60		
	(c) Drive face wheel ahead	19	20		
	(d) Move shaft back	6	36		
	(e) Drive off old pinion	19	20		
	(f) Drive on new	19	20		
	6. Remove guards			18	80
	7. Remove gear from dryer			96	00
	(a) Jack dryer up	72	00		
	(b) Drive off gear	24	00	43	50
	8. Get gear from tank house	1	00		
	(a) Go to office				
	(b) Get team	20	00		
	(c) Go to tank house	2	50		
	(d) Load gear on	8	60		
	(e) Haul to platform	2	00		
	(f) Unload	6	40		
	(g) Take to job	3	00		
	9. Put gear on			46	60
	(a) Drive gear on	36	40		
	(b) Put in key	10	20		
	10. Lower dryer			18	00
	11. Put gear and pinion in mesh			12	00
	12. Remove chain falls			12	00
	13. Put back caps			16	88
	14. Line up			24	00
	15. Allowed for taking shaft out and taking to MM shop and helping install			120	00
	16. Put back guards			37	60
	17. Adjust and see that all is working properly			30	00
	18. Clean up after job			15	00
	19. Trips to store for material			20	67
	20. Return to mechanical office			1	00
	Tools				
	Jacks — Allowances—2% Sharpen tools				
	Chain falls — 10% Fatigue				
	Sledge hammer — 25% Contingencies			258	86
	Wrenches				
	Cold chisels	15.10	hrs.	906	00
	Pinch bar				

Time taken 14 41
Time allowed 15 10

If operation cannot be done according to these instructions, notify foreman or Mechanical Dept. office	**Time Allowed**	**Hours**

Return this card to office with completed job ticket	**Signed** W. H. Pooler	**Month** 5	**Day** 8	**Year** 20

FIG. 6 INSTRUCTION CARD

Showing detail operations to be performed, detail times allowed for performance, and total time allowed for job.

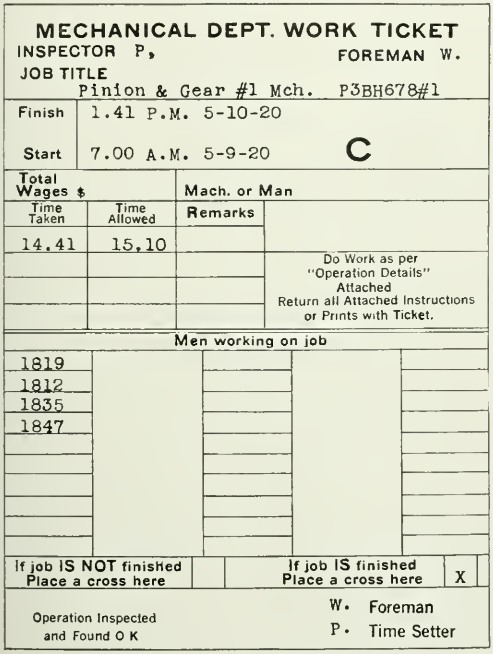
Method of Obtaining Standard Times

So much for the make-up and general method of handling the repair work. Let us now discuss the application of elemental time study to the determination of the standard times for doing the different repair operations. The general scheme of these time studies presented nothing new. Their applications, however, evolved certain difficulties worthy of mention. The chief of these was the unusual complexity and lack of systematic recurrence of the operations making up any repair job. It was found absolutely necessary to resort to the most complete analysis possible of each operation in order to study the effect of petty variables. Thus, such an operation as clamping two pieces of metal together with a nut and bolt was split into the following units:

1. Align bolt holes.
2. Pick up and insert bolt.
3. Pick up nut and start on with fingers.
4. Turn nut on as far as possible with fingers.
5. Pick up and adjust wrench to size.
6. Tighten nut with wrench.
7. Lay down wrench.

The time required to perform such

an operation with a $\frac{3}{4}$ in. bolt is about half-a-minute. Four of the seven elements (1, 2, 3, 7) will each consume 0.03 min. or less. On repetitive work, units of this duration and even smaller are readily recorded.



MECHANICAL DEPT. WORK TICKET
INSPECTOR P. FOREMAN W.
JOB TITLE
Pinion & Gear #1 Mch. P3BH678#1
Finish 1.41 P.M. 5-10-20
Start 7.00 A.M. 5-9-20 C

Total Wages $		Mach. or Man
Time Taken	Time Allowed	Remarks
14.41	15.10	

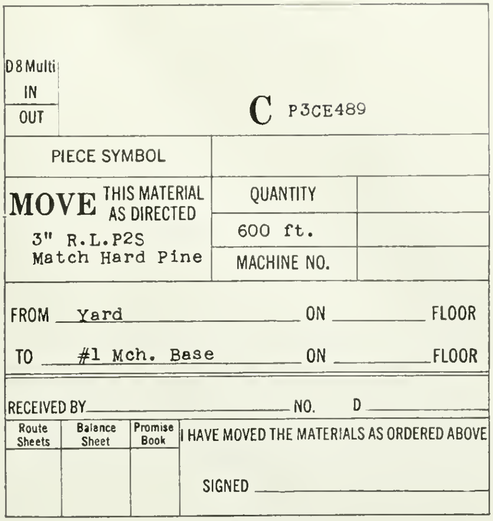
Do Work as per "Operation Details" Attached
Return all Attached Instructions or Prints with Ticket.

Men working on job
1819
1812
1835
1847

If job IS NOT finished Place a cross here ☐
If job IS finished Place a cross here ☒

Operation Inspected and Found O K
W. Foreman
P. Time Setter

FIG. 8 JOB TIME TICKET



D8 Multi
IN
OUT
C P3CE489

PIECE SYMBOL	
MOVE THIS MATERIAL AS DIRECTED 3" R.L.P2S Match Hard Pine	QUANTITY 600 ft. MACHINE NO.

FROM Yard ON FLOOR
TO #1 Mch. Base ON FLOOR
RECEIVED BY NO. D

Route Sheets	Balance Sheet	Promise Book	I HAVE MOVED THE MATERIALS AS ORDERED ABOVE
			SIGNED

FIG. 9 MOVE TICKET

The difficult feature here, however, was the lack of repetition. Thus, very frequently, time studies of work occupying one hour have been observed without a single recurrence of the same operation. We found that while such complete time studies gave very satisfactory results, they were most arduous to take on account of this non-repetitive feature. The great variety of operations was especially disconcerting as the possibility of single letter mnemonic symbols were quickly exhausted so that two- and three-letter symbols with marginal notes were often required properly to describe the observed units.

This difficulty of getting really complete and accurate time studies of typical repair jobs coupled with the dissimilarity and inconsistency of observed times led to the adaption of what were called "theoretical" time studies. These were conceived for the purpose of making up tables of standard times for such millwright operations as sawing boards and timbers, driving nails, boring holes with brace and bit, and laying out work with a rule; for such blacksmith operations as heating, bending, and cutting iron and steel; for such machinist operations as inserting and removing lathe dead centers, shifting cone belt, changing feeds, etc. On tabulating the time studies of actual jobs, or "mill" studies as they were designated, after several months' work with the millwright crew, a difficulty was encountered which may be illustrated as follows:

We had, for instance, a time for driving a 10-d nail into a spruce board, observed on one man on a

JOB ORDER ROUTINE

MAJOR JOBS

1. JOB ORDER REQUEST
   Foreman reports necessity for job to his Dept. Head who writes request for work in triplicate retaining one copy for his file.,
2. PRELIMINARY ENG. LAYOUT
   If necessary to make accurate estimate of job cost possible.
3. PRELIMINARY COST ESTIMATE
   By estimating engineer. This detailed estimate submitted to department head for approval.
4. FORMAL ESTIMATE
   A summary of detailed estimate. To be approved by general department head and by resident manager.
5. COMPLETE ENG. LAYOUT
   If necessary.
6. JOB ORDER ROUTING
   a. Material specifications.
   b. Operations written.
   c. Bonus times set.
7. ORDERING OF MATERIALS
   By material clerk—job released when all materials are on hand or in sight.
8. ORDER OF WORK CLERK
9. JOB EXECUTION

MINOR JOBS

1. JOB ORDER REQUEST
   Foreman reports necessity for job to his Dept. Head who writes request for work in triplicate retaining one copy for his file.
2. ENGINEERING LAYOUT
   If necessary.
6. JOB ORDER ROUTING
   a. Material specifications.
   b. Operations written.
   c. Bonus times set.
7. ORDERING OF MATERIALS
   By material clerk—job released when all materials are on hand or in sight
8. ORDER OF WORK CLERK
9. JOB EXECUTION

EMERGENCY JOBS

1. Telephone call
2. JOB ORDER REQUEST
   Written by Mechanical department. File copy to department head.
3. JOB EXECUTION
   Foreman summoned and job started 5-10 min. after receipt of telephone call. Inspector assigned to job assists in procuring material and furnishes instruction card and bonus time allowed as soon as possible after start of job.

FIG. 10. JOB ORDER ROUTINE
Showing steps involved in planning jobs.

certain job; a second time for driving a 15-d nail into hard pine observed on a different man on a different job; a time for a 20-d nail in hardwood for another man; and a time for a 30-d nail in a spruce beam laid overhead for a fourth man, etc. On trying to derive a relation between the time required to drive these different size nails under uniform conditions we found ourselves completely at sea owing to the large number of variables entering into the observed times. Resort was therefore had to "theoretical" time studies. A first-class carpenter was chosen from the crew, several different kinds of wood and different size nails gotten together and the time-study man and artisan were sent off in the corner by themselves to determine how much longer it took to drive a 15-d nail than it did a 10-d nail with everything else constant.

This was done with all of the different size nails in several kinds of wood. A few pounds of nails and a dollar's worth of wood were used up, but more was learned about the time required to drive nails in the two days spent on this particular experiment than had been derived in the several months previous from mill studies. The times which were gotten under these ideal conditions were, of course, faster than those observed under average mill conditions. Having determined, however, once and for all, the relation which existed between different size nails, and knowing, for instance, from "mill" studies how long it took to drive a 30-d nail into an overhead beam, it was easy to deduce how long it should take to drive a 10-d nail under similar conditions.

A great many of our standard times have been obtained in this way. There are certain types of work such as babbitting bearings, hanging and lining shaftings by the millwrights, laying heavy pipe lines by the pipers, making heavy welds by the blacksmiths, etc., which could not readily be handled by theoretical studies. It was found, however, that theoretical units could sometimes be applied, in part at least, to this type of work. For instance, the nut and bolt times which were obtained theoretically could be used in checking the observed mill times for taking apart a bearing preparatory to babbitting, or for assembling the bearing after the babbitt had been poured and scraped.

The methods used in taking time studies, setting standard times, and making bonus payments with examples of the procedure used, will be described in a second article to appear in an early issue of MANAGEMENT AND ADMINISTRATION.

Group Insurance for the Southern Pacific Railroad Company

Index Number
658.3253 Group insurance

THE world's record was made when the Southern Pacific Railroad insured over 75,000 of the 90,000 employees under the Group Insurance Plan. The plan went into effect January 1, and the first deaths on the system after the plan became effective occurred January 2.

Insurance is offered to the 90,000 employees of the Southern Pacific Railroad Company and its various subsidiaries, as a result of a contract made by the company with the Metropolitan Life Insurance Company of New York.

On the first day of January this year more than 85 per cent of the company's employees who were eligible had subscribed for the insurance available under the company's group life insurance plan. By April 1, 93 per cent of the eligible employees had applied for insurance and the total amount carried under the company's group contract amounted to $116,343,250.

The insurance plan went into effect January 1, and immediately its great practical value to relatives and dependents of insured employees was demonstrated. Several deaths occurred in Southern Pacific organization early in January. Payments were made at once to the beneficiaries. The first deaths after the plan became effective were those of Benjamin N. Howarth, store agent at the Los Angeles store, and of John Williams, a mason in the bridge and building department at Ogden. Both men died January 2. Payments under the group insurance policy were made to the beneficiaries January 4.

Under the plan the Southern Pacific Company provides an initial amount of insurance free of cost to each employee who has been in the company's service six months or more, and the employees who have been in continuous service one year or more will be given the privilege of subscribing for additional insurance at a very small cost, regardless of their age or physical condition, if in active service.

The work of informing the employees of the insurance plan, and of obtaining their applications, with all the numerous details, was directed by Auditor T. O. Edwards. Insurance application blanks with pamphlets giving the details of the insurance plan were placed in the hands of employees, and the officers of the various departments, divisions, shops, and other units were engaged in telling the forces under their supervision about the plan and the many benefits accruing from it. The insurance company also supplied a number of men to assist with this work.

The group insurance plan, through the company's liberality in assuming a substantial part of the cost of it, gives each employee a chance to get life insurance at rates far below the usual rates for such protection. it affords protection for his family and himself at such small monthly cost that it can hardly be noticed.

An employee whose wage rate is $150 or less a month has only to spend 70 cents a month for a total of $1500 insurance to which he is entitled, including the $500 insurance the company furnishes free of cost. The Southern Pacific's group insurance plan makes it possible for thousands of men and women to get needed insurance without physical examination, at a very low rate, who perhaps otherwise could get no insurance at all because of ill health or physical disabilities. There is no secret about this insurance and the employee does not lose any of his rights by adopting it.

Seasonal Storage of Coal

Summary Report of Storage of Coal Committee of American Engineering Council

At frequent intervals, American industry and commerce experience serious interruptions and sustain grave losses because of an inadequate coal supply.[1] Parallel with this condition the coal industry is in an unstable and hence uneconomic situation. No one group associated with the production, transportation, or consumption of coal is solely responsible for the ills that have sorely affected the coal industry, and no one of them unassisted, can effect the cure. Co-operation in action, based on mutual recognition of the benefits to be realized by each group through stabilizing the coal industry, is the only foundation on which remedial measures may succeed. But it is the coal consumer who must start the cycle that will bring about a stabilized industry. The producer of coal, the carrier, and the public official collectively are helpless without the active aid of the consumer. *In the last analysis it is the consumer that will profit most by any improvement in coal procurement.*

Effect on Industries of Fluctuating Coal Demand

American industry is vitally affected by interruptions in coal production and transportation in other ways than through the consequences of a fluctuating coal market. In many manufacturing processes continuous operation is essentially important. The consequences of inadequate supply and inferior quality of coal for these processes are often very grave. Furthermore, the necessary curtailment of production for want of coal disarranges purchasing, sales, and fiscal plans. Industry is also concerned with the proper functioning of the country's transportation agencies, which deliver to industry its raw materials and distribute its finished products. Hence a stabilization of the load factor of the railways is of the utmost importance to American industry. The movement of coal in late fall and early winter, overlapping as it does the shipment of agricultural products, has repeatedly resulted in transportation delays. Industry has lost far more through such causes than through the fluctuation in coal prices themselves.

In this report a simple and practical remedy is set forth whereby the consumer may eliminate uncertainties regarding the quantity and quality of his coal supply. Its adoption will require no radical changes. It will entail but a slight increase if any, in the consumers' annual coal bill. Eventually, with the general adoption of the method proposed, his coal bill will be materially lessened through a reduction in production and transportation costs due to stabilization.

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The method recommended is the seasonal storage of coal by consumers.

The report discloses that seasonal storage by the consumer is an essential and necessary step toward stabilizing the procurement of industrial coal. It is an economic and practical means of insuring an adequate supply and satisfactory quality of coal when needed. The report shows further that through a general and regular practice of storing coal many ills attending coal production may be eliminated.

The irregularity in coal production is largely due to seasonal demand. Since more coal is consumed in the late fall and in the winter than at other periods, coal producers and carriers each year are confronted alternately with a feast and a famine—with an inordinate demand for coal and transportation, followed by a period of no demand. This seasonal demand directly affects the rate of production and is responsible for 47 per cent of the idle time of the coal industry.

Effect in Coal Industry of Seasonal Demand

Seasonal demand also contributes to another very disturbing element, namely: the overdevelopment of mine capacity through opening too many mines. Coal production capacity is now twice as large as the consumption capacity. The two factors—intermittent or seasonal operation and overdevelopment—are in a very large measure responsible for the present unfortunate condition of the coal industry.

Seasonal Storage of Coal

Among the numerous solutions for the coal problem, extending as far as strict governmental regulation and even governmental ownership and operation, which have been proposed or given consideration by Congress, the United States Coal Commission, and other bodies, the project of seasonal storage of coal has naturally received much attention. While, however, there has grown up a large amount of information relating to coal storage, the information has never been brought together and properly analyzed, interpreted, and disseminated for use. Advocates have contended that an extension of the practice of storing coal on the part of producers, dealers, and consumers would materially relieve the intermittent aspect of the coal industry; would result in an ample coal supply at all times; would reduce peak demand upon and facilitate a more economical use of transportation facilities; would permit a larger reliance upon water transportation; would reduce mine operation costs and transportation expense; and would lead to a reduction in the cost of coal to the consumer. On the other hand, there have been emphatic declarations that the storage of coal is impracticable because of the financial burden involved, danger from spontaneous combustion, degradation due to breakage, and loss of heat value and deterioration of firing qualities. In the absence of any authoritative statement in the matter the consumer has had no adequate guide in determining his own policy regarding the storage of coal, and no uniform or general practice has been followed.

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[1] In the early part of 1923 the Administrative Board of the American Engineering Council authorized the appointment of a committee to investigate the seasonal storage of coal and the effect of such storage in stabilizing the industry. The committee as appointed included W. L. Abbott, Chairman; H. Foster Bain, William H. Blauvelt, O. P. Hood, W. H. Hoyt, W. J. Jenkins, David Moffat Myers, Edgar S. Nethercut, S. W. Parr, P. F. Walker, Roy V. Wright. The present summary report prepared by the committee sketches briefly the situation, the purposes of the investigation, and gives the constructive and very important conclusions reached by the committee.

Action by Federated American Engineering Societies

Consideration of the vital importance of the coal situation to industry, and particularly the thought of the possibilities offered by storage, prompted the American Engineering Council, in the spring of 1923, to undertake, through its Administrative Board, a comprehensive study of coal procurement and storage.

It was thought that an analysis and interpretation of the best and most authoritative information regarding the storage of coal would correct many false impressions associated with the subject. Furthermore, it was believed that by the presentation of facts relating to the engineering, chemical, and economic phases of the subject, there would follow an improved condition in the operation of the coal industry and those utilities and industries where coal is the source of power and heat. Accordingly the Administrative Board of the American Engineering Council at a meeting held in Cincinnati, Ohio, March 23 and 24, 1923, officially authorized the appointment of a Committee on Storage of Coal to make a comprehensive study, and approved an outline to guide the investigation.

The committee appointed was composed of 11 men versed in the following factors appertaining to coal: its mining, transportation, engineering, chemistry, combustion, large and small scale storage, distribution, financing, and the several relationships of these factors.

Attitude of United States Coal Commission

In regard to the storage of coal and the Council's investigation thereof the United States Coal Commission stated in its report of September 1923:

> As has been repeatedly shown in these reports, the peak demand for coal involves a peak demand for coal transportation too acute to be adequately met by the railroads, except by an unwarranted expansion of rail equipment and facilities. The removal of the peak therefore appears to be the direct remedy, and the consumer can contribute to the removal of the ups and down of the coal business by buying for regular delivery and balancing seasonal variations in consumption by storage.
>
> Storage of coal by consumers is the balance wheel between fluctuating consumption and variable production. Regular, systematic, large-scale storage of bituminous coal, then is the public's largest opportunity in helping to solve the coal problem, and the consumer's responsibility may be said to be proportionate to his annual requirements. It is especially gratifying, therefore, that the railroads, the public utilities, the iron and steel industry, and other large users of bituminous coal in the United States have undertaken storage on a large scale. The definite adoption of this policy by the larger railroads and public utilities is plainly in the public interest, and never before has the outlook been more promising for the continuation and extension of this direct method of stabilizing coal production. We commend also the present activity of the American Engineering Council in promoting the storage of coal by practical investigation and popular education.

The committee presents the following findings and recommendations as to:

1. Production and distribution of coal in the United States.
2. Extent of the practice of storing coal.
3. Methods and equipment of storage plants and the physical and operating problems involved.
4. Coal required by localities, and advantageous points of storage.
5. Transportation problems.
6. Cost of installing and maintaining coal handling and storage equipment.
7. Cost of actual storage, including problems of finance, insurance, and taxation.

A careful analysis of the information obtained and herein presented brings out the following important findings:

1. The storage of coal is essentially necessary as an aid to the solution of the national coal problem, and is an economic and practicable means of insuring an adequate supply of coal as needed.

2. If each coal consumer will adopt the policy of annually purchasing coal on a uniform monthly delivery basis, there will result automatically sufficient seasonal storage to guarantee coal to the consumer, as needed. Furthermore, this policy will bring about a uniform demand for coal whereby the coal producer and carrier may establish uniform and standard production and shipment schedules. It will also remove the evils of intermittent operation of coal mines, frequent panicky market conditions, and coal shortages due to inability of the carriers to meet peak demands.

3. The amount of storage required to produce these corrective and constructive results is small in terms of the per cent of annual consumption. For seasonal storage, from 9 to 10 per cent of the annual consumption is all that is required. If this amount is supplemented by additional reserve storage of no more than 7 per cent, there will result an accumulation of some 83,000,000 tons of coal in storage by September 30 of each year. The practicability of this amount of storage with but slight additional outlay for equipment is indicated by the fact that in September 1923, 56,000,000 tons were in storage.

4. Equipment has been developed and may be secured to meet any storage situation or requirement. The cost

of such equipment ranges from a few cents per ton of capacity up to $2.50 or $3.00 per ton of capacity.

5. Storage of coal presents no serious risk of loss from breakage, spontaneous combustion, or loss of heat value or firing qualities. All kinds of coal have been and may be successfully stored. The insignificant money loss due to the factors named above should not deter any one from storing coal. Application of the simple and inexpensive regulations and practices set forth in this report will provide all reasonable safeguards against such possible losses.

6. The cost of storage per ton, including fixed charges on equipment, maintenance, and operation expense and interest on investment in coal as well as taxes and insurance in most instances does not exceed 75 cents per ton yearly; more generally it is around 50 cents. This cost is insignificant when distributed over annual consumption.

7. Storing of coal may be easily financed. Banks will finance such an investment as readily as any other commercial undertaking.

8. The transportation facilities of the United States are adequate for normal and regular movement of coal. For short periods the railways can move coal at an abnormal rate, but this is both expensive and detrimental to shipment of other commodities and to normal freight movement.

9. To increase transportation facilities to meet the peak demands resulting from the prevailing unsystematic practice in coal shipment would require an additional investment of some $12,000,000,000. Such an investment is not justified.

10. The railroads have more to gain by storing coal than any other class of consumer. They should store their own coal on such a scale and at such times as to obviate the movement of company or non-revenue producing coal during the period when there is a heavy demand for the transportation of revenue-producing freight. They should abandon, however, the uneconomic practice of using freight cars for storing coal and thereby withholding railroad equipment from other uses.

11. In general, storage should take place at the point of use, to accomplish the most in relieving transportation and safeguarding supply. However, under some circumstances, storage at an intermediate point is advisable.

12. In general, storage at mines is not recommended, but there should be sufficient mine storage facilities and capacity to overcome ordinary operating delays, such as belated arrival of cars, temporary breakdown, or idleness of mining equipment and the like. Such provision would materially increase the producing hours of mines and miners.

13. Cars should be assigned to mines upon the basis of coal actually sold and not upon rated capacity of production. This measure would be a wholesome deterrent to overdevelopment of coal-producing facilities.

14. While this study refers primarily to industrial consumers of bituminous coal, yet householders have also a direct responsibility. Indeed the householder is in a position to aid with the least cost, because no special equipment for storing and reclaiming is required and his individual investment in coal is relatively small. Householders use approximately 50,000,000 tons of bituminous coal annually, which, if placed in their bins by the end of September of each year would materially contribute to the solution of the coal problem.

15. Federal, state, city, and other civic divisions of the body politic are not meeting their responsibility in relation to the seasonal storage of coal. They are as derelict in regard to seasonal storage as are other users, and frequently add to a confused situation by securing priority orders. Public officials should take the lead, by precept and by example, in furthering the storage of coal.

16. Contracts for coal should be observed with fidelity. The evil practice of indiscriminate breaking of coal contracts has seriously injured the American coal industry with reference alike to production, transportation, and consumption. Contracts for coal should be observed with the same good faith as universally prevails in regard to other forms of commercial contracts.

17. Confirmation of the practicability of coal storage is afforded by the anthracite coal industry. This industry is far more stable than the bituminous, because producers, carriers, and consumers of anthracite coal for a number of years have alike encouraged and practiced storage during the summer and fall months.

Committee Recommendations

The committee recommends and urges that all coal consumers purchase their coal on an annual contract for yearly requirements with a provision that the coal be delivered monthly in equal allotments. The committee further recommends and urges that consumers provide necessary storage facilities to meet the terms of such contract. These recommendations are based upon the finding that the purchase of coal upon a uniform monthly delivery basis will result in a condition whereby:

1. Coal mines may inaugurate and maintain a regular production schedule.
2. Carriers may plan definitely as regards both schedules and equipment for a uniform movement of coal.
3. Stocks of coal automatically will accumulate during the months from April to September inclusive in sufficient amount to meet the extra consumption during the winter months.
4. A reduction in the price of coal will be made possible by more regular schedules of production and transportation and by elimination of peak demands in the winter months when the costs of both production and transportation are the highest.

The committee reiterates that the coal consumers through seasonally storing coal can and should initiate this vitally necessary cycle of changes.

These recommendations have been made by competent men after an exhaustive study of the situation. There is no question that some remedy for the present evils must be found. The plan offered is scientifically sound and appeals to the intelligence of every coal user. It should be adopted.

THE EDITORS' PAGE

A Solution of the Coal Problem

"EMINENTLY practical" is the first comment inspired by the summary of the report of the subcommittee of the American Engineering Council which has been engaged for more than a year in studying the procurement and storage of industrial coal. "What a simple solution of the coal problem," is the immediately following second thought. To gain the benefit of any remedy someone must initiate the proposed change. Appreciating this fact the committee places upon the consumers of bituminous coal—that is, upon industrial executives—the responsibility for initiating a cycle of imperatively needed changes in the coal industry.

After stating that "the storage of coal is essentially necessary as an aid to the solution of the national coal problem," the committee advocates "a policy of annually purchasing coal on a uniform monthly delivery basis" declaring that therefrom will result automatically sufficient seasonal storage to guarantee coal to the consumer as needed. Furthermore, it declares that this policy will bring about "a uniform demand for coal whereby producer and carrier may establish uniform and standard production and shipment schedules," and that it will remove the evils of "intermittent operation of coal mines, panicky market conditions and coal shortages".

As proof that this policy is practical the committee finds:

> The amount of storage required to produce these corrective and constructive results is small in terms of the per cent of annual consumption. For seasonal storage, from 9 to 10 per cent of the annual consumption is all that is required. If this amount is supplemented by additional reserve storage of no more than 7 per cent, there will result an accumulation of some 83,000,000 tons of coal in storage by September 30 of each year. The practicability of this amount of storage with but slight additional outlay for equipment is indicated by the fact that in September 1923, 56,000,000 tons were in storage.

The question which will come to the mind of an industrial executive who plans to adopt this policy is, what handling equipment is available for storage; what is its cost; and what is the cost of storage? As an answer to this question the committee shows that equipment is available to meet any storage situation or requirement from, say, a few hundred tons per year up to hundreds of thousands of tons per year, and that the cost of such equipment may be but a few cents per ton of annual capacity. The finding in regard to cost is:

> The cost of storage per ton, including fixed charges on equipment, maintenance, and operation expense and interest on investment in coal as well as taxes and insurance in most instances, does not exceed 75 cents per ton yearly; more generally it is around 50 cents. This cost is insignificant when distributed over annual consumption.

There is no difficulty in financing coal storage, for banks will loan to cover such an investment on the same basis as for other similar commercial undertakings.

The impact of these findings, therefore, is upon the management, which must adopt better methods of procurement and employ adequate equipment for storage to start the changes which will solve a problem that has been long troublesome and disturbing to American mine operators, coal carriers, industrial managers and the public.

The Handwriting on the Wall

THE new immigration law became effective July 1, 1924. Under its quotas the total number of immigrants admitted from European countries is reduced approximately one-half. Beyond this the shifted basis of computation brings about a striking difference in the character of the immigrants admitted. The following list—divided into two groups according to the general character of immigration—includes all the European countries of present immigration importance with the quotas for each under both the old and the new laws.

COUNTRIES	OLD LAW	NEW LAW	PERCENTAGE OF OLD QUOTA
Czechoslovakia	14,357	3,073	....
Italy	42,057	3,845	....
Poland	30,977	5,982	....
Total	97,391	12,900	14.7
Danzig	301	2 228	....
Denmark	5,619	2,789	....
Germany	67,607	51.227	....
United Kingdom	77,342	62,574	....
Norway	12,202	6.453	....
Sweden	20,042	9,561	....
Total	183.113	134,782	73.6

From the first group with its greatly lessened quotas come the hewers of wood and the drawers of water—coal-miners, construction gang men and other manual laborers. From the second group come the more skilled laborers—machine operators or artisans.

The immigration from the second group is reduced to approximately three-fourths of its former volume—from the first group it is but little more than one-seventh of its former volume.

What does all this mean to the manufacturer? First that the already scant supply of labor is going to be still further reduced. Secondly that this reduction will be most severely felt in the ranks of manual labor—

that the general character of his imported labor will be raised.

Taking a step further the restricted supply of labor means that in the face of falling prices—which are likely to continue slowly falling for many years—the daily wage of labor cannot be materially reduced; on the contrary it may, in some instances at least, be actually increased. And as prices must be reduced while wages are stationary, or perhaps increase, this means that the manufacturer must in some way—by standardization—by elimination of hand labor—by more efficient utilization of what labor he has—or by some other method which does not involve a wage cut, reduce the labor cost of his output. To express it briefly his problem is the increase of per capita output.

The problem is difficult and in most cases unescapable. On the other hand, it is not at all an impossible problem. The manufacturer who faces it squarely and works out an intelligent solution is likely to succeed, and profit greatly. The manufacturer who does not work out some successful solution is likely, at some not distant date, to reach the condition of Bret Harte's geological debater, who after the solar plexus impact of a chunk of old red sandstone—

> smiled a kind of sickly smile, and curled up on the floor,
> And the subsequent proceedings interested him no more.

A Preventable Waste

THE Forest Products Laboratory of the United States government estimates that the use of unsuitable and unscientifically designed freight containers results in an economic loss to the nation of $500,000 a day.

The American Railway Association through its Committee on Freight Claim Prevention has been working, in conjunction with the Forest Products Laboratory, to find a way to prevent the enormous losses resulting from faulty box construction. The methods they have found suitable for the purpose are so simple, so easily applied, that they should be quickly adopted by all American shippers.

The first recommendation is that more consideration be given to nailing. Tests made at the Forest Products Laboratory show that the majority of failures of ordinary boxes are not due to the lumber with which the box is made but to improper nailing. In fact, by using a few more nails in right places, suitable boxes can often be made of thinner lumber, thus reducing the cost as well as preventing damage. Increasing the number of nails used 50 per cent usually will increase the strength of the box 100 per cent. Cement-coated nails should be used as they have almost double the holding power of smooth nails. The National Association of Box Manufacturers has prepared a chart showing the proper size of nails to be used for various thicknesses and kinds of woods, and the number to be used on different sized boxes. Every shipper should provide his shipping department with a copy and insist that its recommendations be followed.

Metal strapping all boxes is the second recommendation made. The efficacy of this construction is evidenced by a series of tests made on an average box by the Forest Products Laboratory. The unstrapped box failed after 100 drops in the testing machine; a strap around its center enabled it to withstand 320 drops; and with a strap at each end 610 drops were required to render the box unserviceable. Box strapping results in a stronger but lighter shipping package which prevents damage and pilfering, but lowers freight charges.

A Hard Problem Solved

APPLICATION of the principles of good management has extended rapidly since they were first introduced to industry some 20 years ago by Dr. Taylor. There are few manufacturing concerns of importance that are not applying those principles to some extent in their management and administrative work. Control of productive processes was the first step, followed by scientific study of personnel problems, accounting and cost finding, financial control, etc., until now there is hardly an administrative or management factor that has not been influenced by the desire for more accurate information and more precise control of industrial processes.

There were, however, certain types of processes which did not readily lend themselves to scientific control, and so have been more or less neglected in discussions of scientific management applications. Maintenance and repair work is a very good example. This type of work, because of its irregular nature, has made difficult any attempt to plan jobs, while the use of time studies and the adoption of a wage-payment plan based on them has been considered practically impossible.

The Eastern Manufacturing Company has developed a method by means of which such work can be planned and routed and accurate time studies can be made of jobs upon which they are able to base a bonus system of wage payment. A detailed study of the methods used has been prepared by Theodore Clark, in charge of the work, the first part of which appears in this issue. The plan of procedure is relatively simple—surely no more complicated than similar plans for controlling other production processes—yet it gives positive control over a class of work which has been considered beyond the reach of science.

The results of this application have been as satisfactory as could be desired. A study of 100 repetitive jobs under day work and bonus showed a saving for bonus over day work of 54 per cent in time, and over $1500 after allowances had been made for increased overhead due to the bonus plan. Average earnings on bonus jobs have increased 43 per cent over day work, and during the 4 years the plan has been in operation the company has not lost a man from the mechanical department as a result of men leaving for higher paying jobs.

These results are real and are based on sufficient experience to be of real value. The Eastern Manufacturing Company has solved a difficult problem in such a way that others can benefit by their experience.

THE READERS' PAGE

Standardization of Forms

In the Management Data Summary No. 27 in your June issue entitled "Standard Forms for Office and Shop Use," the following statement appears:

> When the kind of paper has been selected according to the above considerations, the size for each specific purpose must be determined. Sizes are based upon dimensions of original sheets, and involve two requirements, for best results.
>
> 1. For economy, they should cut without waste from original sheets.
> 2. For simplicity, the number of sizes used for all purposes should be limited to a reasonable minimum, avoiding abnormal dimensions.

Two tables follow, the first showing 132 sizes of forms (containing some duplicates), and the second 207 sizes.

Although nine sizes are "recommended as ample for practically every requirement of the average business organization," the effect of the recommendation is nullified by the statement that "new forms should be built on a standard size sheet, rather than cutting sheets to fit the form".

This whole method seems to be putting the cart before the horse, and to lead directly away from standardization. A more reasonable procedure in drawing up a form is as follows:

1. Find out the main purpose the form is to serve.
2. Make a list of the information which is to appear on the form.
3. Find out where and how the form is to be filed.
4. Determine the size of the form, i. e., taking into consideration the space required for the necessary information and the file in which the form is to be placed, select one of the following sizes:

3 x 5 in.
4 x 6 in.
5 x 8 in.
8½ x 11 in.
8½ x 14 in.
11 x 17 in.

5. Determine the paper to be used (kind, grade, weight, and color) according to its use requirements.
6. Have the printer select a sheet on which to print the form which will give the least waste, taking into consideration the size of the press and the length of the run.

The six sizes listed above have become so universally accepted that files, desks, binders, typewriters, and other office appliances, to fit these sizes, can be purchased from practically every manufacturer, and the savings made possible by using standardized equipment are greater than the savings due to using up all the paper in the sheet. For instance, the difference in cost between a standardized file and one specially built would wipe out possible savings in paper for 50 years or more.

Yours sincerely,
Wallace Clark

There is a splendid chance for an argument on Mr. Clark's view that limiting the number of form sizes is far more important than obtaining paper economy. Against him might be arrayed the increasing cost of paper, the necessity for conserving our natural resources in the form of timber, the influence of the government through the Bureau of Standards committee on simplification of paper sizes, and the ever-growing belief throughout the country that waste of any sort should be eliminated.

There is, however, no need for argument since the article referred to took no sides on the question. Placing the subject of economy before that of simplicity was not done with the intention of giving the former more importance. Both are essential to economical manufacture and use of forms—to argue their relative merits would lead nowhere.

Contrary to Mr. Clark's implication these two conditions are not at all incompatible. Two form sizes may be selected whose respective dimensions are so similar that either will satisfy the use and filing requirements necessary. One size can be cut without waste from standard paper sheets, the other cannot. In finally selecting the size to be used why should not this factor be considered and the size chosen which can be manufactured economically? It was to emphasize the fact that there is an economy factor in selecting form sizes that the article to which Mr. Clark objects was prepared. That, for some unknown reason, management engineers have neglected to consider it is well evidenced by the 4 x 4 machine form recommended and approved by many engineers. This size cannot be cut from any standard sheet without waste although there are several similar sizes such as 3 3/4 x 4 and 4 x 4 3/16 that would have served the purpose just as well and, in addition, could be cut without waste.

We entirely agree with Mr. Clark's viewpoint that the number of sizes should be limited. We desire, however, to introduce scientific standardization into the work of simplification rather than relying on rule-of-thumb methods such as accepting past practices as a guide for the future.

With the particular point brought up by Mr. Clark in regard to his six forms our article agrees. The first three sizes are commonly used for index cards and all can be cut without waste from standard sheets of index bristol. The last three sizes can be cut without waste from standard sheets of flat papers. Although all of the sizes recommended by him are not included in the published list of nine that is a matter of small importance at the present stage of form standardization.

Mr. Clark's list may be just as satisfactory as ours for fulfilling all use requirements. We dislike his method of obtaining it, however, since it is, apparently, only by chance that each of the forms he has chosen can be manufactured economically. We believe that selection for manufacturing economy is important, and when it has no effect on the use of the form or the filing equipment we fail to see why consideration should not be given to relative costs.

Executive Positions Wanted

IN the May number of MANAGEMENT AND ADMINISTRATION you printed on page 584 a letter from "Henry Warren" detailing his experience in trying to secure a satisfactory position and asked some executive with experience on the other side of the fence to present his comments on the situation.

In our work as employment managers, during the past five years, we have worked with more than 500 corporations in locating and investigating capable men. If the need for capable men were not keen, no employer would be willing to pay to get a good man. The fact that we are in business would seem to prove that the trouble does not lie in that the positions are not open or that the employers are not interested in getting the best possible men into their organization.

Mr. Warren's difficulty has come partly at least from the fact that there has never been any meeting place at which employers and employees could get together. The employment agencies, as a rule, operate locally, while high-grade men frequently move from one city to another. The employer who is badly in need of assistance is handicapped in his efforts to get a man in several ways: if he advertises over his own name, he is flooded with unqualified applicants and the sons and friends of his customers, stockholders, directors, and relatives. When an employer comes out in the open, he invites serious trouble and usually gets it. If he advertises blindly, he usually finds that capable men are not reading and answering blind advertisements. Few capable men will answer keyed advertisements. If the employer "feels around among the trade," he gives away very valuable trade information to his competitors, who use it against him.

Now, then, after an employer gets in touch with a number of men, what does he do? As a rule, he flounders. His job is not hiring men, but making candy or selling shoes or building heavy machinery. He finds when he gets to an interview that he really does not know where to begin—he has no specifications of the position open and he does not know how to investigate.

From the employee's side of the fence, probably the most effective instrument to use in securing a position is a direct mail campaign. The man should write a letter to an employer who is typical of a large class and then send this letter to one hundred or two hundred employers. If Mr. Warren did this and did not secure satisfactory results, then there was something the matter either with his record or in his presentation of it, because a well-written letter designed to sell a first-class $3,000 man ought to pull from 7 to 10 per cent interested replies. If Mr. Warren wanted a $5,000 salary, then his letter should have pulled from 2 to 8 per cent interested replies.

It is unfortunate that the universities and educational institutions which take thousands of dollars of a man's money for educating him are not able to help a man to sell himself nor to put into his mind an appreciation of the importance of certain fundamentals. The executive who goes out to get a job is trying to sell a high-priced article. The employer who hires a high-grade man does not hire him for a day or a month or a year, but he hopes, for life. In 10 years Mr. Employer pays Mr. Five-Thousand-Dollar Employee $50,000, but the man looking for the position never thinks of it this way. If he were to sell a $10,000 automobile, he would expect the buyer to want to know all about the varnish, the kind of wood in the spokes, etc., and he would be prepared for the specific questions, but not one man in a thousand ever really studies himself before he starts out to get a job.

Nowhere in Mr. Warren's article can I find any evidence that he has been able to get the employer's viewpoint. An employer goes into business for just one reason—to make money. When he hires a man, he does not simply go out and hire someone for the sake of paying a salary. What he tries to do is to find someone who can help him make money. The man looking for a position should show that he appreciates the importance of this point. He should not talk all the time about his education and experience and that sort of thing, but get down to brass tacks and present in as interesting a way as possible proof of what he can do for the employer.

Mr. Warren asks why business men fight so hard against a remedy for the trouble in which he found himself. The answer is—they don't! Put yourself for a moment in the employer's position. You have 50 things which must be done today and you know that no matter how hard you work, you are only going to do 25 of them. Some fellow comes in looking for a job. He has no idea of what your proposition is and has no knowledge of how to sell himself. In the previous month, you have talked with a dozen men just like him and not one of them was worth while. Naturally, you are going to be rather "hard boiled." This is the real answer to the situation. The thing for the man who wants a job to do is to determine

1. What it is that he has to sell.
2. What the employer's needs are.
3. How he fits into the picture.

When he gets the answers to these questions then he should write an employer a letter and tell the employer what he can do for the position. The burden of proof is on the man who wants a job.

Sincerely yours,

WILLIAM L. FLETCHER

NEWS OF EQUIPMENT
FOR THE MANAGEMENT

This department is conducted to give our readers essential facts regarding items of industrial equipment recently placed on the market, that may be used to increase production or lower costs. Each item is indexed according to the Dewey Decimal System so that it can be accurately filed for future reference. The editors will be glad to furnish additional information about any item. All information given is obtained from reputable manufacturers, and MANAGEMENT AND ADMINISTRATION accepts it as reliable.

Coal Feeder

Index Number 658.28 Service equipment

THE Barber-Greene Company is making a materials handling device which forms a connecting link between the belt-conveyor and railroad car for speeding up the unloading of coal, coke, cinders, shale, or similar material. It will be most useful in plants where it is not desirable to install elaborate track pits and similar equipment. The feeder is designed to work in connection with belt-conveyors in unloading railroad cars or reclaiming storage piles. It can be set on top of the rails, in a temporary pit under the rails formed by removing one tie, or in a permanent concrete pit under the track. The advantages claimed by the manufacturer in using the feeder are: greater unloading speed; elimination of shovelers; track pits unnecessary; increased conveyor capacity; and increased conveyor life.

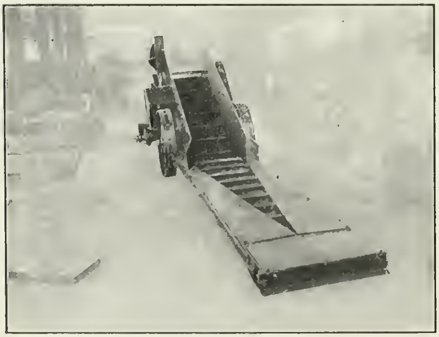

FIG. 1 COAL FEEDER SHOWING ADJUSTABLE PLATES

The feeder is of the drag or flight type. Flights are made of heavy built-up channel shapes fastened at each end to steel bushed roller chains running in a steel trough. Adjustable plates on the top of the horizontal end can be set to regulate the capacity of the feeder. The steel trough and vertical sides are renewable.

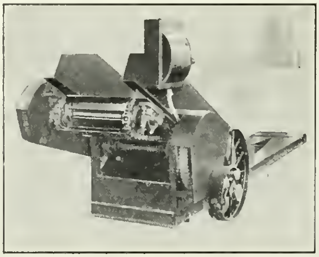

FIG. 2 MOTIVE END OF COAL FEEDER

The device is driven through 2 sets of gears and chain. Shafts are cold-rolled steel running in ball and socket bearings. A friction clutch is provided for stopping or starting the machine. Power is furnished by a 5 hp., 1750 r. p. m. electric motor.

The feeder is nearly balanced on a 2-wheel truck with 30 x 5 in. wheels so that it can be moved about with comparative ease.

Flights are spaced 10 in. apart and travel 46 ft. a min. Effective width of the feeder between skirt plates is 20 in. making it possible to handle run-of-mine coal. Capacity ranges from 40 to 90 tons an hr. of coal or similar material.

Flat Roof Construction

Index Number 695 Roofs and roofing

A LIGHT weight, fireproof, flat roof which is watertight, durable, and economical has been placed on the market by the Truscon Steel Company. The construction makes possible roofs with slope of ½ in. in 12 in. The deck is of copper steel with stiffening angles welded to the plates to add strength and rigidity. Eaves, gables, ridges, and gutters are reinforced. It is designed for a 40 lb. live load but has been tested up to 160 lb. without failure. Because of its light weight—4½ lb. a sq. ft.—a considerable saving should be possible in the cost of purlins, trusses, columns, and foundations.

The flat surface is adaptable for the application of built-up roofing materials which are cemented to the steel with roofing pitch. Expansion and contraction are automatically taken care of at the joints, which occur every 2 ft., so that cracking, sagging, twisting, or warping should be eliminated. The form of construc-

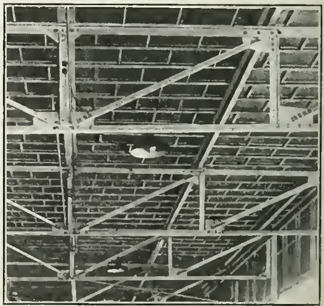

FIG. 1 UNDER SIDE OF FLAT ROOF

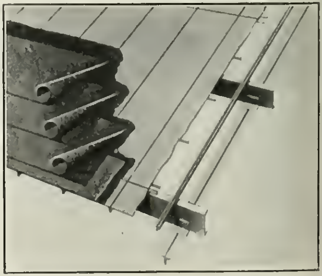

FIG. 2 FLAT ROOF SHOWING HOW BOND BETWEEN DECK AND ROOFING IS SECURED

tion leaves a clean, smooth surface which can be painted easily, and forms a good light reflector.

Integrating Flow Meter

Index Number
621.1875 Flow meters

A FLOW meter for measuring the flow of steam, water, or air in pipes has recently been placed on the market by H. S. B. W. Cochrane Corporation. The deflecting and actuating member of the meter is a U-tube containing mercury, and balanced upon a knife edge. Pressure from the two sides of a metering element, such as an orifice in a steam line, are led to the 2 limbs of the U-tube through small flexible torsion tubes. The pressure differential set up by flow through the pipe line forces mercury from one side to the other in the U-tube, causing it to tilt. There are no working parts inside the pressure box, no stuffing box and hence little friction.

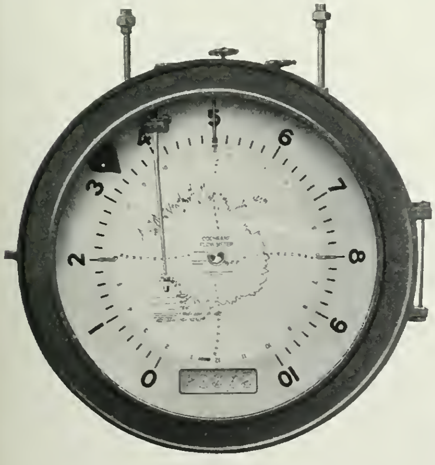

Fig. 1 Integrating Flow Meter

The integrator used with the meter is driven solely by a clock, the deflecting member of the meter merely controlling the position of a stop or motion limit pin. The integrator goes through the motions of drawing a line from zero to the pen trace on the chart once each minute, the length of this line being proportional to the momentary rate of flow, and the sum of the lines is proportional to the total flow for a definite period. The manufacturers claim that this instrument when properly adjusted will give results within 1 per cent of absolute accuracy in a run during which flow varies from 20 to 100 per cent full load rating.

Portable Air Compressor

Index Number
621.52 Air compressors

THE Ingersoll-Rand Company is offering a small portable air compressor plant, designated as the "$4\frac{1}{4}$ x 4 in. Type Twenty". It will supply necessary air for operating a rock drill, riveting hammer, calking or chipping hammers, etc., and has a piston displacement of 60 cu. ft. of air per min. This new unit has the same general construction as previous units of the same line, including: duplex vertical compressor; direct connected to a 4 cylinder, 4 cycle, tractor type gasoline engine; enclosed construction; one-piece cast steel frame, etc.

It can be furnished with a variety of mountings, steel wheels and axles; wooden artillery wheels with solid rubber tires and steel axles; on a Ford truck; or on skids for mounting on a car or truck. Either gasoline engine or electric motor drive is available.

Because it can be moved about easily it should be useful in supplying air for erection and repair work and many odd jobs of painting, cleaning, etc., in places where air lines have not been installed.

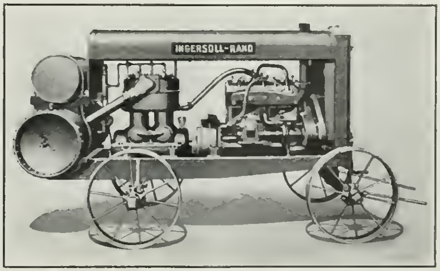

Fig. 1 Portable Air Compressor

Adjustable Insert for Mounting Machines

Index Number
621.715 Machinery foundations

IN order to overcome the difficulty sometimes experienced when imbedding machine mounting bolts in a concrete base, in making the bolts register correctly with the mounting holes of the apparatus, an adjustable insert has been developed by Westinghouse Electric and Manufacturing Company.

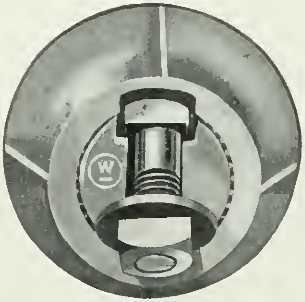

Fig. 1 Adjustable Insert for Mounting Machines

It consists of a cast iron housing with a tapering body which contains a rotatable bolt carrier. The carrier is T-slotted to take the head of a $\frac{3}{8}$ in. or $\frac{1}{2}$ in. standard machine bolt, and is of sufficient length to permit a $\frac{5}{8}$ in. movement of the bolt from the center. The insert is fastened to the form at the point where the bolt is desired. After the concrete has been poured and set a bolt of the proper length is placed in the bolt carrier. By rotation of the carrier and lateral motion of the bolt in the slot the bolt is placed in the correct position to receive the base of the machine to be mounted. The housing and bolt carrier are provided with teeth which mesh and prevent any movement of the bolt after the adjustments have been made to locate it at the proper point.

Portable Arc Welder

Index Number
621.392 Arc welding

A NEW portable arc welder that can be moved about a plant and used on all sorts of welding jobs is being manufactured by the General Electric Company. It can be used with any of the commercial sizes of metallic electrode from 1/16 to ½ in. diameter. Generator voltage can be adjusted to suit the character of the work. Any value of current between 70 and 300 amperes can be obtained. It is designed to insure rapid deposition of metal with thorough penetration and to deliver continuous power and permit rapid production.

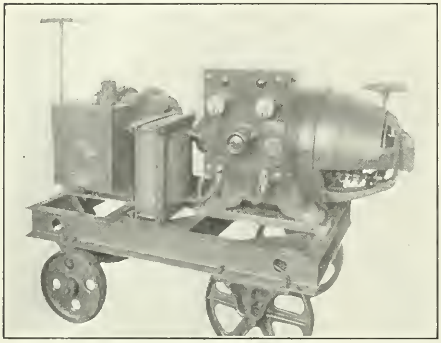

FIG. 1 PORTABLE ARC WELDER

The welder consists of a motor and a generator. The generator is self-excited. A self-adjusting, stabilizing reactor is provided which automatically steadies the arc. The motor is a standard GE 10 hp. unit. Operating features are an arc easy to start and maintain, roller-bearing wheels, holes in base for crane hooks, and adaptability for long or short leads. All parts are mounted on a welded structural steel base. The assembled unit is about 63 in. long, 29 in. wide, 47 in. high, and weighs about 1600 lb.

Locomotive Tractor Crane

Index Number
658.281 Tractor cranes

A CRAWLING tractor crane that operates with clamshell or dragline bucket, electro-magnet, hook and block, or grapple, and can be converted into a shovel or pile-driver, has been developed by the Industrial Works. Its capacity is 10 tons and is known as Type D.

Traveling, hoisting, and slewing motions are independently controlled so that hoisting and slewing motions may be combined in bucket work, with traveling, for high speed operation. A slewing brake holds the boom, with a suspended load, in any position. When operating on uneven ground this prevents sudden rotation of the loaded boom with its possible disastrous results. The upper works rests on a steel base that rotates on 4 conical steel rollers. Steel side frames carrying the shaft bearings are bolted to this rotating bed. Running bearings are provided with replaceable bronze bushings. Gears in upper works are cut steel. Tractor shoes are steel and operate over adjustable idle sprocket bearings which take up the slack in the tractor belt. The bed plate mounted on the car body is cast steel containing a circular roller path and external skewing rack. A steel hollow center post is pressed into this base plate to form a center of rotation for the superstructure.

The crane has 2 traveling speeds and reversal of direction is obtained by reversing the engine. Steering is accomplished through friction clutches and brakes controlling each tractor belt. Either belt may drive, coast, or be held by brake to negotiate as sharp or as wide a turn as may be desired. All operating levers are placed in 2 rows at the front of the operator's platform which is located on the right side of the superstructure where a full view of the work can be obtained. Either steam, gasoline, or electric power can be furnished.

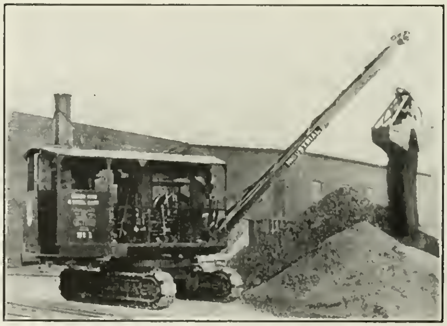

FIG. 1 LOCOMOTIVE TRACTOR CRANE

Electric Screw Driver

Index Number
621.7161 Electric screw driver

AN electric tool for use by manufacturers of furniture, automobile and truck bodies, pianos and other equipment in the construction of which numbers of wood screws are used, is called the Steptoe Electric Screw Driver and is manufactured by The John Steptoe Company.

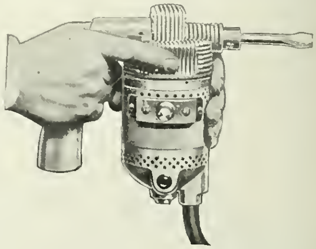

FIG. 1 ELECTRIC SCREW DRIVER

The tool weighs 5 lb., and can be held in one hand, but is powerful enough to drive larger screws than can be driven by hand—no. 16 screw, 3 in. long, into undrilled, hard yellow pine, for example. It can be used for driving or removing screws by placing a bit on each end of the spindle. Only one hand is necessary to operate it, the clutch being placed in operation after the bit is placed in the screw slot, by pressing down on the screw. An aluminum pistol grip handle is furnished with each machine.

The motor runs at 10,000 r.p.m. and is reduced to spindle speed through gear and worm drive. It is air-cooled by means of a fan machined from a bronze casting. Each machine is equipped with a 10 ft. conductor cord with separable attaching plug, and one tool steel bit.

Desk File

Index Number
651.236 Panel files

A FILE to contain thousands of items of information, which may be referred to or added to conveniently and which may be kept on an executive's desk, is being marketed by Postindex Company. It consists of a metal cabinet which holds aluminum panels to which are attached index cards. The cards lie flat for easy posting and nearly the entire surface of each card is available for writing. Each panel goes easily into and out of its section in the cabinet on metal rollers. Forms may be easily removed or new forms inserted. Panels hold from one to 150 2-, 4-, or 8-page forms, and are made in different widths to hold records from 5 to 11 in. wide. Cabinets are built to hold 5, 10, 15, or 20 panels. They can be finished in mahogany, oak, or circassian walnut to match office furniture, or in regulation green. Sizes of cabinets vary from 8 x 20 x 10 in. high for the smallest which holds 750 5 x 3 or 6 x 4 in. folded forms to 28⅞ x 20 x 10 in. high built to hold 3000 forms.

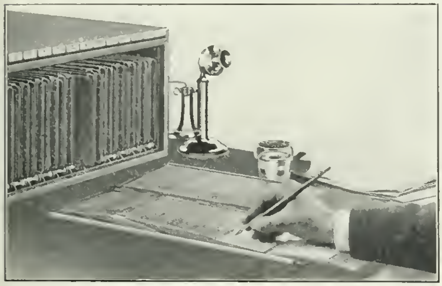

FIG. 1 NEW DESK FILE

Portable Electric Meters

Index Number
621.3175 Electric
meters

FOR general service and for particular use in industrial plants, in shop and field testing work, and other applications where accurate but rugged instruments are desired, the Roller Smith Company is marketing 4 instruments, all type GSA. Ammeter, ranging in capacities from 0-100 milli-amperes to 0-300 amperes. Voltmeter, capacities from 0-10 volts to 0-750 volts. Volt-ammeter, capacities from 0-10 volts, 0-100 milliampere to 0-750 volts, 0-300 amperes. Wattmeters, capacities: single phase, 1 ampere, 100-150 volts, 0-125 watts to 50 amperes, 400-600 volts, 0-25 kw., polyphase, 5 amperes, 100-150 volts to 5 amperes, 400-600 volts, 0-5 kw.

All instruments are furnished in hardwood cases and dust- and moisture-proof. Dials are of white bristol board; scales are drawn by hand; and pointers are knife-edge type with mirrors under the scales. Instruments are provided with a zero adjuster, phosphor bronze springs and Ceylon sapphire jewels. A hinged dropcover to protect the glass and a carrying handle are furnished so that a separate carrying case is unnecessary. Average size of instruments is 7 x 7 x 4½ in., average weight 4½ lb., shipping weight 12 lb.

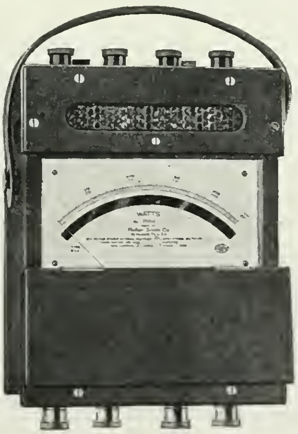

FIG. 1 PORTABLE ELECTRIC METER

All instruments are accurate within 1 per cent of full scale value at any point on the scale, and are readable from about 20 per cent to 100 per cent of full scale value. These meters are designed for alternating current use but, with the exception of volt meters of under 150 volt range, may be used on direct current satisfactorily.

New Time Relay

Index Number
621.3117 Electric
relays

A NEW type of AC definite time relay, known as the MC-9, developed to fulfil the need for a relay that will give a definite time delay so necessary in many types of magnetic controllers, has been placed on the market. This device is especially applicable to automatic starters for AC motors to give a definite time interval between the closing of the contactors used in accelerating the motor. In addition to being used for accelerating on synchronous motor starters, it automatically energizes the field circuit after the motor is up to full speed.

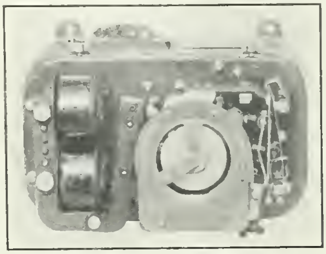

FIG. 1 NEW TIME RELAY

The device is made by the General Electric Company and consists of a diminutive constant speed bi-polar induction motor operating a tripping mechanism through a gear train. The time delay is determined by the arc through which the tripping mechanism must be turned by the motor before it actuates the contacts. The time delay adjustment is made without the use of tools by moving an index over a calibrated scale on the face of the relay. Time delays of from ½ to 33 seconds on 60 cycles, and to 123 seconds on 25 cycles may be obtained.

The relay is designed for wall or panel mounting and is enclosed in a dust-tight, sheet metal case with the leads brought out at the top of the case. The dimensions of the complete unit are 8 x 6 x 5¼ in. and the weight approximately 12 lb.

Recording Door Lock

Index Number
658.283 Electric
door locks

A RECORDING door lock for use in offices, storerooms, banks, or any place where it is desirable to know who locks or unlocks doors and when, is being marketed by the International Business Machines Corp. A bolt equipment accompanies the door locks. Bolts are attached to all other doors, windows, skylights, chutes, etc., in the building. The main controlling door lock cannot be locked unless all of the other entrances and exits are securely bolted. The lock is operated by electricity controlled by a self-winding clock which can be hung anywhere. A number of keys can be used, and each time a key locks or unlocks the door a plain legible record of the time, whether the door was locked or unlocked, and whose key was used, is printed. A special keyhole is provided where watchmen can record the time of their visits but cannot unlock the door. There is no clock mechanism on the door itself so the mechanism cannot be put out of order by slamming or tampering. Any style of hardware finish can be furnished. Yale lock mechanism is used.

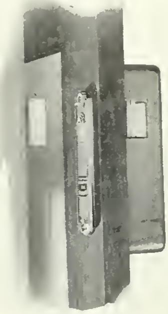
FIG. 1 RECORDING DOOR LOCK

FIG. 2 MASTER CLOCK

Remote Control Switch

Index Number
621.3117 Electric switches

A NEW switch adapted for remote control of lighting circuits and for the control of motors operated by tank switches, pressure gages, thermometers and similar devices, called the Triplock Switch, is being sold by the Monitor Controller Company. It is electrically operated, mechanically locked, and cuts off its own operating current. There is no current in the switch coils except at the instant of closing or opening, so the coils are small and of low resistance. Sufficient current is taken when closing to exert a strong pull; giving a sharp contact which is maintained by a mechanical lock.

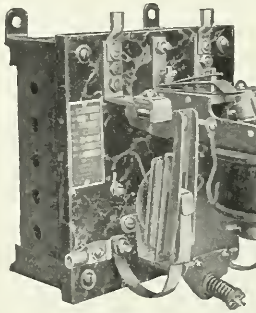
FIG. 1 TRIPLOCK SWITCH

As a result the switch may be used with three-wire maintained contact form of remote control without consuming any energy except during the moments of closing and opening.

Identiscope

Index Number
658.3123 Employee photographs

A DEVICE for providing means of identifying employees or other services where quick and positive identification of persons and their signatures is desired is being marketed by the Yawman and Erbe Mfg. Company and is called the Identiscope. It consists of a camera so constructed that with instantaneous exposure, simultaneous photographs are made of the subject and his signature or other descriptive matter. No special lighting facilities are needed as the button which operates the camera also operates an electric lamp which produces the proper light. Photographs of the person and his signature appear on the same print which may then be filed for future reference.

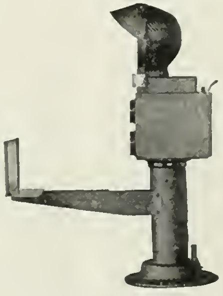
FIG. 1 IDENTISCOPE

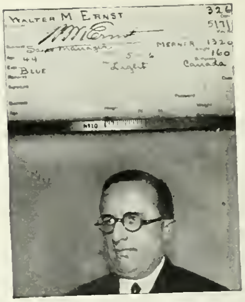

FIG. 2 IDENTISCOPE PRINT

Steel Pole

Index Number
691.7 Steel poles

A POLE which is strong, rigid, durable, and economical has been designed and will soon be placed on the market by the Truscon Steel Company for use on transmission, distribution, telephone, lighting lines or other places, where a pole is necessary. It is pressed from 5 to 12 in. steel channels or I-beams and is so designed that no special equipment or pole steps are needed for climbing it. A portion of the web of the channel or I-beam is pressed out to a predetermined angle and riveted to a similar section of another channel or I-beam.

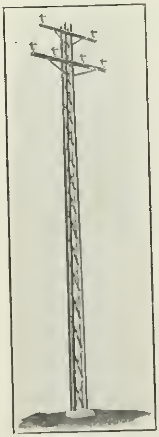
FIG. 1 NEW STEEL POLE

The manufacturers claim that when this pole is anchored in concrete and painted about once in 5 years it will last indefinitely. Its cost is about the same as that of wood poles. Where more than ordinary strength is required 2 or more poles can be combined.

CURRENT INFORMATION INDEX
FOR THE MANAGEMENT

The material indexed in this department is selected by the editors of MANAGEMENT AND ADMINISTRATION from upwards of 150 magazines; it also includes the publications of some 50 book publishers and professional societies as far as these are of managerial interest to industrial executives. The items are prepared and classified by the Engineering Societies Library in New York City. The decimal number at the right of each item is the index number and indicates the place the article or book will take when filed in accordance therewith in the classified subject scheme. If articles are grouped according to these numbers like subjects will automatically fall together and related subjects will follow in logical sequence. Photostat copies of any magazine article indexed can be supplied by The Ronald Press Company for a moderate charge. The books and pamphlets indexed can be procured from their respective publishers.

Accounting

Auditing and Accounting Handbook. 657.7
By Frederick W. Kilduff. 813 pp. McGraw-Hill Book Company, New York. $6. Divided into 11 sections. Section 1 is devoted to preliminary auditing procedure, operations of audit, special notations and miscellaneous audit data. Section 2 discusses various schedules by means of which an auditor's findings are usually expressed. Section 3 consists of a series of questions under appropriate headings, the answers to which are intended to give a comprehensive picture of a manufacturing concern. Section 4 is devoted to inventory and consists mainly of a list of items of materials with unit of measure and information necessary to describe each. Section 5 treats property classification and records, and contains a list of items of physical property and materials showing classification and depreciation rate for each. Section 6 contains a short discussion of depreciation. Section 7 consists of sample financial statements and forms. Section 8 is a table of accounts. Section 9 is devoted to mathematics. Section 10 consists of some 300 pages of tables and miscellaneous information. Section 11 is a brief discussion of Federal Income Taxes.

The Control of Idleness in Industry. 657.452
W. L. Conrad. *Mechanical Engineering*, July 1924, v. 46, pp. 402-404. Expense of man and machine idleness, its measurement, methods of elimination, and certain fallacies of cost accounting.

Costs and a Cost System. 657.452
H. P. Dix. *American Machinist*, June 5, 1924, v. 60, pp. 853-855. Records necessary for a simple system of cost accounting. How to determine what the list price of machinery should be.

How We Make It Easy to Apply the Ounce of Prevention in Management. 657.452
A. B. Nevins. *Factory*, June 1924, v. 32, pp. 813-816, 932. Cost accounts, workers' record cards, and "burden budgets," as an aid in checking waste, by calling attention to production details which need remedying. How labor turnover is watched and controlled by the Shaw-Walker Company.

Recording Job Costs to Show Profits.—6 Profitable Methods for the Small Factory. 657.452
G. C. Brown. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 53-58. Illus. Second article on cost methods in a small plant. This considers only the actual recording of monthly costs.

The Wastage of Industrial Plants in Relation to Cost Accounting. 657.452
Andrew Stewart. *World Power*. June 1924, v. 1, pp. 318-324. The measurement of "wastage" or depreciation and how it may be included in operating costs.

Advertising

An Example of Scientific Marketing Procedure. 659.1
Stuart Cowan. Bulletin of the Taylor Society, June 1924, v. 9, pp. 143-151. Charts. A survey of the distribution of magazine circulation among classified earning groups for the purpose of determining their advertising value.

How We Co-ordinate Advertising and Selling. 659.1
S. E. Conybeare. *Advertising and Selling*, July 2, 1924, v. 3, pp. 23-24, 60. Teaching the salesman the principles of advertising and how to use them in his job.

What Kind of Copy Sells Goods in the British Market. 659.13
Gilbert Russel. *Advertising and Selling*. July 2, 1924, v. 3, pp. 25, 42-47. Discusses 10 different copy styles and comments on English and American methods.

Who Pays for the Advertisement That Doesn't Pay for Itself? 659.1
K. M. Goode. *Advertising and Selling*. July 2, 1924, v. 3, pp. 17-18, 36. Summarizes and abstracts answers received from 35 sales executives.

Building and Equipment

Construction and Costs of Southern Cotton Mills and Equipment. 658.2:577
R. G. Macy. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 47-52. Illus. Describes especially the new type of mill buildings, their equipment, heating, lighting, and power supply. Cost estimates are given.

Electricity in the Paper Industry. 658.26
W. W. Spratt. *Paper Trade Journal*, June 19, 1924, v. 78, pp. 46-50. How electricity can be applied to driving machines of the paper industry. Advantages of the sectional machine drive.

Figuring Light Cost in Increased Production Instead of Watts Consumed. 658.242
R. J. Waldo. *Factory*, June 1924, v. 32, pp. 816-818. Essentials of a good lighting system which will increase production and contentment among workers.

How to Choose Leather Belting to Suit the Job. 658.2621
C. O. Streeter. *Belting*. June 1924, v. 24, pp. 32, 34, 36. Things to know about. Waterproof belting successfully used. Hints on selection, use, and maintenance of belts.

Light and Work. 658.24
By M. Luckiesh. 296 pp. D. Van Nostrand Co., New York. $4. A discussion of quality and quantity of light in relation to effective vision and efficient work. Proper lighting is receiving increased attention by industrial concerns, since there has been shown to be a close relation between the amount and quality of light, with which workmen are provided, and their productive output. The author discusses daylight indoors and artificial light. The use of color, fundamentals and speed of vision, relation of lighting and production, and the most effective and economical intensities of illumination are discussed. Tables and illustrations are freely used increasing reader interest in the book which should prove valuable to industrial executives.

Maintenance of Plant Equipment. 658.2
W. L. Hitt. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 43-45. Charts. Practical suggestions for supervising building maintenance and repair. Describes routine adopted by the East Pittsburgh plant of the Westinghouse Electric.

Power Station Efficiency Control. 658.26
By John Bruce. 244 pp. Sir Isaac Pitman & Sons, New York. $3.75. An outline of practical methods for obtaining boiler-room efficiency, turbine-room efficiency, and heat balance control. It describes methods of recording and tabulating operating results and of keeping day-to-day check on operating efficiency. It is not very technical but is written more in the form of an operating handbook for combustion engineers. It contains a number of illustrations including charts and diagrams. The subject matter is of practical value and since it is based on English practice may contain some valuable suggestions to American readers.

Proper Painting as an Aid to Interior Illumination. 658.24
W. Sturrock. *National Safety News*, June 1924, v. 9, pp. 31-33. How paint on walls and ceilings aids in light diffusion, in reflection, in minimizing shadows, in reducing glare, and how it can be applied to machinery to improve local lighting.

Slow-Speed Steam Engines for Industrial Purposes. 658.26
D. S. Capper. *World Power*, June 1924, v. 1, pp. 353-357. Individual power plants versus centralized power. Steam power plant may be more economical and more efficient, depending on location of plant.

Economics

Banker Reviews Business Year. 332
B. P. Sherwood. *Michigan Manufacturer and Financial Record*, June 21, 1924, v. 33, pp. 14, 57. A general survey covering the last decade, mentions the Dawes report, the Mellon tax bill compromise, etc.

Construction and Costs of Southern Cotton Mills and Equipment. 38(75)
R. G. Macy. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 47-52. Illus. Describes especially the new type of mill buildings, their equipment, heating, lighting, and power supply. Cost estimates are given.

Disturbing Factors in Industry. 331.87
W. L. Huggins. *Brick and Clay Record*, June 10, 1924, v. 64, pp. 881-885. Discussion on organized labor and its efforts to dominate and control all industry. Popularly written.

Handbook of Mathematical Statistics. 31
H. L. Rietz, Editor-in-Chief. 221 pp. Houghton-Mifflin Co., Boston. $4. The study of a problem by statistical methods usually involves 3 stages: collection of the data; their mathematical analysis; and their interpretation. This book discusses the second stage only, since the editor believes that regardless of the particular field of the inquiry the form of the mathematical analysis of data obtained is essentially the same so that its discussion has general applicability. Special emphasis has been given to the limitations to the applications of various methods of analysis. The handbook should be valuable to practicing statisticians and students of statistical methods.

Securing Funds for Business Expansion. 332.6
A. M. Leinbach. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 33-38. Banks, bonds, loans, and how to establish credit. The business of securing funds or selling loans must be based on the same principles as merchandising any commodity.

This Year's Outlook for Business. 338.97
R. Trangmar. *Michigan Manufacturer and Financial Record*, June 21, 1924, v. 33, pp. 19, 60. Discusses address of J. C. Howell of the Brookmire Economic Service which forecasts a period of dull business during the summer months with a rapid recovery in the fall.

Fuel

Burning Low-Grade Fuels in Pulverized Form. 662.65
E. K. Scott. *The Gas World*, June 7, 1924, v. 80, pp. 69-72. Cites cases where pulverized fuel has been successfully used, shows its advantages, and directs attention to the possibility of using such low-grade material as coal-cutter cuttings, material in pit heaps, etc.

Coal Storage and the Avoidance of Spontaneous Combustion. 658.78:662.65
J. B. C. Kershaw. *Gas Age Record*, June 7, 1924, v. 53, pp. 787-789. Conditions which cause oxidation of coal, and methods of storing—in heaps, overhead bunkers, and under water.

Determination of Volatile Matter in Coal and Coke. 662.65
The Gas World, June 7, 1924, v. 80, pp. 61-64. Describes various experiments which have been made, resulting in a reliable scientific method for determining the volatile matter in coal and coke.

Efficiency in Oil Burning Installations. 621.1845
F. A. Rothwell. *Power Plant Engineering*, June 15, 1924, v. 28, pp. 639-641. The selection of burners, the fuel supply system, drying, firing, dampers, fuel meters, etc.

Fire Precautions for Pulverized Fuel Plants. 662.65
Power Plant Engineering, June 15, 1924, v. 28, pp. 641-643. Segregation of pulverizing plant, ventilation, relief vents, careful selection of fuel lines, instructions for operating the plant, and other means of fire prevention.

The Float and Sink Test for Fine Coal. 662.65
B. M. Bird and H. E. Messmore. *Universal Engineer*, June 1924, v. 39, pp. 32-34. Describes test, apparatus, and procedure.

Practical Coal Carbonization. 662.7412
A. R. Powell. *Mechanical Engineering*, July 1924, v. 46, pp. 389-394. Discusses the technical problems of low-temperature carbonization, and the various processes of heating coal in thin layers, of stirring coal in contact with heated surfaces, of preheating coal, etc.

Use of Pulverized Coal in the Cement Industry. 662.65
L. N. Duryea. *National Engineer*, June 1924, v. 28, pp. 277-279. Illus. Value of pulverized fuel in the Portland cement industry. Pumping coal through pipes, a successful experiment.

Use Oil in Malleable Furnace. 662.75
B. R. Mayne and Carl Joseph. *The Foundry*, June 15, 1924, v. 52, pp. 472-475. Illus. Liquid fuel experience in the Saginaw Malleable Iron Works. Same furnace construction was used and oil consumption considered very low.

Iron and Steel Industry

British Steel Industry Expands. 669.1
W. J. Larke and M. S. Birkett. *Iron Trade Review*, June 26, 1924, v. 74, pp. 1697-1700, 1702. Statistical and economic survey of the iron and steel industry, with special reference to the productive capacity of Great Britain and the probable trend of future development. Abstract of a paper read before the Iron and Steel Section, Empire Mining and Metallurgical Congress, London, 1924.

Straight-Line Production. 669.1
F. J. Crolius. *Coal Industry*, June 1924, v. 7, pp. 224-230. Describes the properties of the Woodward Iron Company in Alabama, methods of mining, equipment for cleaning and concentrating the ore, and transportation to the furnaces.

Straight-Line Production. Part 2. 669.1
F. J. Crolius. *Blast Furnace and Steel Plant*, June 1924, v. 12, pp. 264-267, 305. Features of operation in the Woodward Iron Works, Alabama. Describes method of coking, the Crockard furnace top, and the pig bed machines.

Maintenance

Best Ways to Use Insulating Varnish. 658.581
H. L. Hazeltine. *Industrial Engineer*, June 1924, v. 82, pp. 284-287, 306. Illus. How to protect windings against moisture, oil, metallic dust, and insulation troubles.

Does It Pay to Install Modern Shop Machinery? 658.58
C. A. Shaffer. *Railway Mechanical Engineer*, June 1924, v. 98, pp. 325-328. Factors contributing to the solution of this problem in different types of shops.

Insulating Conditions of Windings. 658.581
Industrial Engineer, June 1924, v. 82, pp. 282-283, 306. Illus. Inspection procedure and cleaning methods before making dielectric tests in alternating current machines.

Organization of Maintenance Division. 658.58
F. A. Waldron. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 39-42. Charts. Comprehensive outline of work belonging to this department in large and small plants. Defines policy, suggests records, and gives organization chart showing control.

Reclamation of Air Brake Material. 658.583
A. Skinner. *Railway Review*, June 7, 1924, v. 74, pp. 1022-1024. Equipment in use at the Atchison, Topeka and Santa Fe Railway's scrap yard at Corwith, Illinois, where standard retainers, K-triple valves, etc., are repaired, tested, and sent back into service.

Management

Elements of Budget Control. 658.14
D. J. Hutchinson. *Pit and Quarry*, July 1924, v. 8, pp. 75-78. Principles of budget-making and control. Favors co-operation of department heads in determining budget.

The Kind of Cost Figures the President Wants. 658.1
Hugo Diemer. *Paper Trade Journal*, May 29, 1924, v. 78, pp. 55-56, 58. The progressive president needs figures and related

facts pertaining to production, selling, administrative, and investment costs.

Securing Funds for Business Expansion. 658.14
A. M. Leinbach. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 33-38. Banks, bonds, loans, and how to establish credit. The business of securing funds or selling loans must be based on the same principles as merchandising any commodity.

Unity in Management Policy. 658.1
W. E. Hotchkiss. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 17-18. Principles of executive control. Emphasizes unity of policy, harmony of procedure, and consistency of practice.

Management and Special Industries

Car Building Program in a Railroad Shop. 658.9:625.2
Railway Review, June 21, 1924, v. 74, pp. 1177-1185. Illus. Description of the various steps in the well-planned production schedule of the Pere Marquette Railway, which turns out refrigerator cars at the rate of 2½ cars per day.

Central of Georgia Reclaims Metal Car Roofs. 658.9:625.2
W. H. Harrison. *Railway Mechanical Engineer*, June 1924, v. 98, pp. 329-332. Illus. Sixty per cent of all sheets removed are restored to service at a cost of $10 per car. Details of operation are described.

Changes in Equipment and Product Preceding Installation of Production Control 658.9:629.113
G. D. Babcock. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 19-26. Illus. Second article of Building Tractors Under Scientific Control. How the Holt Company converted the military tractor into an industrial tractor and installed production control methods.

Constructive Study of Railroad Car Repairs. 658.9:625.2
Railway Review, June 7, 1924, v. 74, pp. 989-999. Illus. A detailed study of the present car shop facilities of a small railroad, with a view to finding some relatively inexpensive means for increasing the efficiency. Factors which enter into an improvement program.

Electricity in the Paper Industry. 658.9:676
W. W. Spratt. *Paper Trade Journal*, June 19, 1924, v. 78, pp. 46-50. How electricity can be applied to driving machines of the paper industry. Advantages of the sectional machine drive.

Evolution of an Indian Progress System. 658.9:625.1
J. R. Mott. *Engineering Production*, June 1924, v. 7, pp. 156-159. Management principles introduced in the railway works of India.

Grinding Practice in Railroad Shops. 658.9:625.2
M. B. Richardson. *Railway Mechanical Engineer*, June 1924, v. 98, pp. 345-348. Illus. Increased production and improved accuracy effected by the use of grinders. Tools and operation are described and illustrated.

Improved Shop Operation at Albuquerque, N. M. 658.9:625.2
Railway Mechanical Engineer, June 1924, v. 98, pp. 333-342. Illus. Charts. Management methods at the new locomotive repair shops of the Sante Fé resulted in a production record of 302 in 1923 against 56 in 1921.

Management Factors in the Shoe Industry. 658.9:685.3
S. E. Thompson and W. E. Freeland. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 75-81. Charts. Methods which solve marketing and manufacturing problems.

Our Industries and National Defense. 355.21
John W. Weeks. *American Industries*, May 1924, v. 24, pp. 5-8. Our need for industrial preparedness in time of peace by the Secretary of War.

Selling the Automobile Overseas. 658.9:629.113
J. D. Mooney. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 27-32. Illus. How General Motors export business is handled.

Yarn and Weight Records in Hosiery Mill. 658.9:677
W. E. Haseltine. *Textile World*, June 21, 1924, v. 65, pp. 53-55. Illus. Describes method of checking weight of goods as knitted, showing variation from standard. Immediate correction prevents waste.

Material Control

Die Bewirtschaftung der Hilfsstoffe. 658.78
Otto Klein. *Zeitschrift des Vereines Deutscher Ingenieure*, May 31, 1924, v. 68, pp. 562-565. Accessory materials, their place in the production scheme, cost, maintenance, standardization, and general principles of material control.

Care and Control of Raw Materials. 658.7851
Factory, June 1924, v. 32, pp. 831-834, 872. System employed by the Bausch and Lomb Optical Company—a central storeroom with branch storerooms. Records necessary for the proper control of these materials.

Evolution of a Stores Department. 658.785
O. Nelson. *Railway Review*, June 21, 1924, v. 74, pp. 1169-1174. Illus. An efficient system employed by the Union Pacific Railroad. Organization, master stock books, supervision, service, standard buildings, material yards, handling scrap, supply trains, etc.

Packing and Shipping Oil and Lubricants. 658.788:665
J. B. Edwards. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 59-64. Illus. Methods in use at the Tide Water Oil Company, whose products are over 350 in number.

Practical Methods for Minimizing Waste. 658.78
C. B. Auel. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 65-70. Illus. Prevention and salvage of waste at Westinghouse Electric through routing of materials and storeskeeping.

Mechanical Handling

Cutting Costs by the Use of Conveyors. 658.28
F. H. Colvin. *American Machinist*, June 26, 1924, v. 60, pp. 969-971. Illus. Some devices which increase economy in the handling of parts by the Maxwell Company.

Fundamental Economics of Materials Handling. 658.281
M. L. Begeman. *Mechanical Engineering*, July 1924, v. 46, pp. 405-410. Advantages of handling materials mechanically without reference to particular types of equipment. Increases production, economizes on floor space, and decreases cost of financing a business.

Labor-Saving Machinery Adopted. 658.28
G. H. Charls. *Iron Trade Review*, June 12, 1924, v. 74, pp. 1563-1564. Lists a number of labor-saving devices used in coke plants, blast furnaces, steel works, and rolling mills.

Materialbewegung in Glashütten. 658.281:666.1
C. Michenfelder. *Zeitschrift des Vereines Deutscher Ingenieure*, May 24, 1924, v. 68, pp. 515-519. Illus. Mechanical handling with trucks and power conveyors in glass factory.

Performance, Type, and Application of Mechanical Coal Loading Devices. 658.28
R. A. Walter. *Coal Mine Management*, June 1924, v. 3, pp. 38-42, 51. Gives classification of loading machines with characterizing information and descriptions of conveyors, shoveling machines, digging loaders, cutters, etc.

Mining

Education as an Aid to Safety in Mining. 622.8
W. H. McMillan. *Iron and Coal Trades Review*, May 23, 1924, v. 108, pp. 876-877. Outlines educational schemes that will lower the accident rate.

The Float and Sink Test for Fine Coal. 622.78
B. M. Bird and H. F. Messmore. *Universal Engineer*, June 1924, v. 39, pp. 32-34. Describes test, apparatus, and procedure.

Hydrotorf. 622.331
R. Klasson. *Zeitschrift des Vereines Deutscher Ingenieure*, June 7, 1924, v. 68, pp. 601-605. Illus. New Russian method of peat working. Describes excavators, pipe lines, drying and other exploitation features.

Industrielle und Landwirtschaftliche Moornutzung. 622.331
Gustav Keppeler. *Zeitschrift des Vereines Deutscher Ingenieure*, May 31, 1924, pp.

585-591. Illus. Industrial value of bog. Peat working, briquetting, etc.

Modern Developments in Coal Conveyors and Haulage Arrangements. 622.6
G. L. Leston. *Colliery Guardian*, May 23, 1924, v. 127, pp. 1320-1321. Illus. Describes a conveyor district, and haulage devices for use on different gradients.

Performance, Type, and Application of Mechanical Coal Loading Devices. 622.6
R. A. Walter. *Coal Mine Management*, June 1924, v. 3, pp. 38-42, 51. Gives classification of loading machines with characterizing information and descriptions of conveyors, shoveling machines, digging loaders, cutters, etc.

Problems of Mechanical Coal Mining. 622.33
S. Mavor. *Colliery Guardian*, June 13, 1924, v. 127, pp. 1510-1512. Deals with mining economics, intensive machine mining, and underground conveying. Abstracts of paper read before the Empire Mining and Metallurgical Congress, London, 1924.

Researches on Safety Problems in Mining. 622.8
Sir Edward Troup. *Colliery Guardian*, June 6, 1924, v. 127, pp. 1441-1445. Covers spontaneous combustion, fire damp, coal dust, use of electricity, and safety lamps. Abstract of paper contributed to the Empire Mining and Metallurgical Congress, London, 1924.

Rock Dusting of Coal Mines. 622.8
J. T. Ryan. *Coal Industry*, June 1924, v. 7, pp. 241-242. Points to be kept in mind in planning to rock dust a mine, and equipment for pulverizing and spreading dust. Estimate of initial cost of equipment for a 400,000 ton mine on a 20-year basis and estimate of operating costs.

Safety in Quarries Should Have More Attention. 622.8
A. H. Findeisen. *Pit and Quarry*, July 1924, v. 8, pp. 87-89. Ways and means of preventing accidents. Statistics for compensable injuries in Wisconsin quarries in 1922.

Straight-Line Production. 622.341
F. J. Crolius. *Coal Industry*, June 1924, v. 7, pp. 224-230. Describes the properties of the Woodward Iron Company in Alabama, methods of mining, equipment for cleaning and concentrating the ore, and transportation to the furnaces.

Underground Safety Story of Zinc. 622.8
G. E. Wallis. *National Safety News*, June 1924, v. 9, pp. 11-14. How the New Jersey Zinc Company safeguards the workers in all operations—mining methods, working conditions, fire protection, mine rescue, ore separation.

Ventilation of Mines. 622.4
D. Hay & R. Clive. *Colliery Guardian*, June 6, 1924, v. 127, pp. 1447-1449. Discusses principles of ventilation and modern practice. Gives tables and diagrams. Abstracts of paper contributed to the Empire Mining and Metallurgical Congress, London. 1924.

Office Methods

Business Mail. 651.457
By H. A. Blackman. 113 pp. Ronald Press Co., New York. $1.25. "Every year the American business man throws into the fire of postal loss over $100,000,000. At least 95 per cent of this staggering loss is the direct result of ignorance in his mailing department." Thus the author states the conditions giving rise to this book in which valuable suggestions are made concerning ways in which postal losses may be decreased. Correct methods of addressing, sealing, stamping, and preparing, for delivery to post office, all classes of mail with the reasons why strict adherence to these methods will obtain quicker and better postal service and avoidance of loss. There will be very few organizations that will be unable to obtain valuable ideas from this interesting book.

Office Building Problems. 658.2:651.1
216 pp. Building Owners and Managers' Association of San Francisco. $2.50. A report of the proceedings of a conference of building owners and managers held at San Francisco, February 1924. Includes the following papers and subsequent discussions: Building planning service; Determining factors in fire insurance schedule rating; Efficient purchasing procedure; Modern salesmanship applied to selling of office space; Owner versus manager; Relation of light and area to value of office space; Some economic losses of bad management; Types of construction, their economies, and advantages.

Organizing the Stenographic Department. 651.374
By Lee Galloway. 100 pp. The Ronald Press Co., New York. $1.25. An ever-present problem confronting the management of business organizations is the present method of organizing and operating the stenographic department. Dr. Galloway offers valuable suggestions by means of which waste may be eliminated and administrative costs reduced. Subjects discussed are: equipment and organization; standardization and stenographic work; measurement of stenographic output; methods of controlling stenographic output; and handling of office detail.

Personnel

Apprenticeship Methods on the Santa Fe. 658.3861
Pt. 1. *Railway Mechanical Engineer*, June 1924, v. 98, pp. 355-359. Illus. Briefly outlines plan, methods of selection, examinations for applicants, etc. Subsequent articles to give more detailed description.

Employee Education in Fundamental Economics. 658.315
C. F. Dietz. Pamphlet, 17 pp. How the Bridgeport Brass Company promotes harmony and interest among its workers by bringing them to understand the purpose, problems, and intimate business details of the industry, and their part in its operation. Address at the annual meeting of the Chamber of Commerce of the United States.

The Modern Executive. 658.31242
Edited by Daniel Bloomfield. 266 pp. The H. W. Wilson Co., New York. $2.40. Consists of a collection of articles and addresses by 25 executives on the general subject of the executive's place in management and how his ability may be recognized and developed. Contents are divided into 6 sections: leadership and the modern executive; the place of the executive in management; what is executive ability; developing executive ability; the foreman as an executive; and the work of the executive.

The Modern Foreman. 658.31243
By Robert Grimshaw. 297 pp. The Gregg Publishing Co., New York. $2.50. A discussion of the foreman's place in industry, his training, duties, and similar factors influencing the success of his efforts. Because of the informal style in which the book is written and the numerous anecdotes used for illustrative purposes it makes very interesting reading. In addition there is considerable valuable material contained in it which should be useful to foremen or executives interested in increasing the value of their "non-commissioned" staff.

Physiological Problems in Mining. 658.382
J. S. Haldane. *Colliery Guardian*, June 13, 1924, v. 127, pp. 1507-1508. Discussion of pathological conditions due to gases, heat, dust and underground infections. Abstracts of paper contributed to the Empire Mining and Metallurgical Congress, London, 1924.

Picking the Foreman Student: A Training Program for the Factory Foreman. 658.31243
J. K. Novius. *The Open Shop Review*, June 1924, v. 21, pp. 231-235. Suggestions on rating prospective foremen and rating charts devised by W. D. Scott.

Praktikantenausbildung. 658.3861
J. Hanner. *Zeitschrift des Vereines Deutscher Ingenieure*, May 31, 1924, v. 68, pp. 569-573. The industrial need for apprentice training in small plants and large. Urges co-operation with technical school.

Problems in Personnel Management. 658.3
Edited by Daniel Bloomfield. 557 pp. The H. W. Wilson Co., New York. $3.50. A collection of papers, articles, and speeches, prepared by men interested in the relations between management and men, which shows the trend, during the last decade, of methods employed to solve the personnel problem. The value of the book to anyone desiring practical information on the subject is considerable although much of it expresses ideas and ideals which may be workable but are still unproved. Containing views of such a large number of men who have gained their experience in many different industries practically every phase of the subject is discussed somewhere in the book. Whoever looks there for new ideas or practices is quite sure to meet with some degree of success.

Proper Training of Shop Supervisory Forces. 658.31243
L. W. Baldwin. *Railway Review*, June 28, 1924, v. 74, pp. 1256-1258. Points out the need for supervisory officers to know the use of machine tools, to keep posted on new appliances, and to keep in personal touch with the men and encourage them in developing initiative needed for advancement.

Psychological Tests in Business. 658.31156
A. W. Kornhauser and F. A. Kingsbury. 194 pp. The University of Chicago Press, Chicago. $2. The use of psychological tests in industry for the purpose of properly adjusting men to jobs is constantly increasing. In spite of the publicity which this movement has occasioned there is still considerable controversy over the practical value of such tests. This book deals with the application of tests to business. It presents a non-technical account of the fundamental principles underlying application of psychology in business, what has already been accomplished in that field, and what are the future prospects. The author's aim has been to present a picture which will enable the reader to arrive at sound conclusions regarding the actual uses of psychological tests in the business world. Their purpose has been achieved in an interesting book which should be useful to personnel managers and other business men interested in the subject discussed.

Recruiting Transportation Employees. 658.3
D. Prins. *Electric Railway Journal*, June 21, 1924, v. 63, pp. 990-991. Personnel problems of street railroad companies. Methods of employment and discipline.

Reducing Eye Hazard in Work. 658.382
L. H. Carris. *Iron Trade Review*, June 19, 1924, v. 74, pp. 1637-1638. Results of investigation of eye hazards in industrial occupations, with recommendations for improving present conditions.

Report of Committee on Industrial Relations. 658.3
M. L. Twomley. *Paper Trade Journal*, June 12, 1924, v. 78, pp. 55-56. A brief general consideration of the subject, and a few recommendations, by a committee of the National Paper Box Manufacturers' Association.

Safety Code in Forging. 658.3823
National Safety News, June 1924, v. 9, pp. 55-61. Tentative draft formulated under joint sponsorship of the National Safety Council and the American Drop Forging Institute. Applies to drop hammers, steam and air hammers, hydraulic presses, rivet-making machines, etc.

The Success of a Theoretical Plan. 658.3156
Deane W. Malott. *American Industries*, May 1924, v. 24, pp. 31-32. Describes the success of the Rockefeller system of joint conferences in use at the Colorado Fuel and Iron Company.

Win the Confidence of Employees by Taking the Mystery Out of Business. 658.31514
C. R. Hook. *Mimeograph*, 7 pp. Methods employed by the American Rolling Mill Company to make the workers understand the factors entering into business. Co-operation effected through advisory committees elected by each department.

Workers' Partnership in Industry. 658.3174
E. H. Gary. *World's Work*, June 1924, v. 48, pp. 197-203. Effective co-operation in the United States Steel Corporation. System of stock subscription and profit-sharing.

Production Control

Changes in Equipment and Product Preceding Installation of Production Control. 658.5
G. D. Babcock. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 19-26. Illus. Second article of Building tractors under scientific control. How the Holt Company converted the military tractor into an industrial tractor and installed production control methods.

The Control of Idleness in Industry. 658.5
W. L. Conrad. *Mechanical Engineering*, July 1924, v. 46, pp. 402-404. Expense of man and machine idleness, its measurement, methods of elimination, and certain fallacies of cost accounting.

Co-ordination of Sales and Production. 658.5
Joseph H. Barber. *Bulletin of the Taylor Society*, June 1924, v. 9, pp. 111-131. Charts. Business cycle study. Details of system that enabled one company to estimate sales in advance, and regulate production accordingly.

Determining the Selling Price of Machine Tools. 658.5
H. R. Simonds. *Iron Trade Review*, July 3, 1924, v. 75, pp. 35-38. Charts. Analyzes the business cycle and suggests methods of leveling the seasonal curve by establishing a running average to the operation of a machine tool plant.

How to Estimate Machine Shop Costs. 658.5421
A. A. Dowd. *American Machinist*, June 26, 1924, v. 60, pp. 963-966. Formula for figuring time necessary for a given cutting operation, device for finding machine speeds from cutting speeds, table of cutting speeds, etc.

How We Make It Easy to Apply the Ounce of Prevention in Management. 658.5
A. B. Nevins. *Factory*, June 1924, v. 32, pp. 813-816, 932. Cost accounts, workers' record cards, and "burden budgets" as an aid in checking waste, by calling attention to production details which need remedying. How labor turnover is watched and controlled by the Shaw-Walker Company.

Inspection System in a Lathe-Building Plant. 658.562
H. S. Riggs. *Machinery*, July 1924, v. 30, pp. 835-841. Illus. Checking the accuracy of lathe parts, assembled units, and the complete machines. Record cards given.

Recording Job Costs to Show Profits—6 Profitable Methods for the Small Factory. 658.5:657
G. C. Brown. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 53-58. Illus. Second article on cost methods in a small plant. This considers only the actual recording of monthly costs.

Train-Despatching in an Automotive-Parts Shop. 658.514
R. S. Spencer. *American Machinist*, June 26, 1924, v. 60, pp. 945-946. How a system like that used by the railroads is applied to controlling the operation of 14 electric trucks between the various departments.

Wirtschaft und Wissenschaft im Technischen Betrieb. 658.5
K. Rummel. *Zeitschrift des Vereines Deutscher Ingenieure*, May 31, 1924, v. 68, pp. 566-569. Co-ordinating the theory and practice of management. Department development must aim at furtherance of plant welfare. Place of research in the scheme of industrial progression.

A Workable Production Control System. 658.5
Edward Davis. *American Machinist*, June 5, 1924, v. 60, pp. 835-838. The second article of a series on methods employed by the Edison Phonograph works. Considers the importance of shipment data, how shipments are scheduled, the progress records, material control, etc.

Selling

Analyzing Credit Risks. 658.882
S. F. Brewster. 107 pp. The Ronald Press Co., New York. $1.25. A sound credit policy is an essential factor in any successful business enterprise. The basis for a sound credit policy is accurate analysis of credit risks. Mr. Brewster gives a clear, concise discussion of principles and methods for analyzing the risk involved in any credit extension. The following subjects are discussed: analysis of mercantile credit; sources of credit information; preparation and analysis of financial statements; description and valuation of assets and liabilities; analysis of corporate financial statements; income or profit and loss statements; and comparative statement analysis.

An Example of Scientific Marketing Procedure. 658.808
Stuart Cowan. *Bulletin of the Taylor Society*, June 1924, v. 9, pp. 143-151. Charts. A survey of the distribution of magazine circulation among classified earning groups for the purpose of determining their advertising value.

500 Answers to Sales Objections. 658.807
Ray Giles. 74 pp. The Ronald Press Co., New York. $1.25. Meeting objections offered by prospective buyers is part of every salesman's job. Most of them are general rather than specific and apply equally well to all lines of business. Because of this Mr. Giles has been able to compile a list of nearly 100 objections actually encountered by salesmen and to suggest 500 replies that can be used effectually to overcome them. Objections and answers are divided into eight classes —price, profit, performance, policy of

buyer, policy of competitors, punctuality, personal, and put off. This book should be of practical value to all persons engaged in selling.

How We Co-ordinate Advertising and Selling. 658.85
S. E. Conybeare. *Advertising and Selling*, July 2, 1924, v. 3, pp. 23-24, 60. Teaching the salesman the principles of advertising and how to use them in his job.

Marketing the Technical Product. 658.82
Eric N. Simons. *Mechanical World*, v. 75, May 23, 1924, pp. 321-322 and June 13, 1924, pp. 369-370. Continuation of an article on engineering publicity. Factors to be considered in planning sales booklets, broadsides, folders, envelope enclosures, showcards, and instructive cards.

Principles of Foreign Trade. 382
C. E. Griffin. 348 pp. The Macmillan Co., New York. $3. The author's aim was to bring the teachings of economic theory into the realm of business and government policy—to provide successful exporters, who need little instruction in the technique of exporting, with an exposition of the economic principles underlying their daily activities. This purpose has been achieved in a readable book that contains much information of value to persons interested in foreign trade. A wide range of subjects is discussed covering all important factors related to the subject. Some of these are: foreign exchange; balance of trade; ocean transportation; financing foreign trade; and government interference.

Selling the Automobile Overseas. 382
J. D. Mooney. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 27-32. Illus. How General Motors export business is handled.

Standards and Tests

Belt Standardization. 658.516
William Staniar. *Belting*, May 1924, v. 24, pp. 48, 52, 54, 56, 58. A study made by the Du Pont Company to determine the most economical type of belt for each of the 2500 drives in the plant, also a study of transmission machinery. Shows the value of these standards in making replacements.

How Belting Was Standardized in a Large Automotive Plant. 658.516
H. A. Flogaus. *Belting*. June 1924, v. 24, pp. 19-24. How belting standards were arrived at and reports on power transmitting property of different belts. (To be continued).

Notes on Testing of Metal Strips. 620.12
L. W. Johnson. *Forging—Stamping—Heat Treating*, June 1924, v. 10, pp. 230-234. Illus. Methods of tensile and bending tests on metal strips. Discusses purchasing specifications.

Some Opportunities to Promote Efficiency. 658.516
F. McManamy. *Railway Review*, June 21, 1924, v. 74, pp. 1218-1219. Points out the value of standardization of railway equipment, of keeping a check on idle equipment, and of a budget system in maintenance expenditures.

Specifications for Pipe Fittings. 621.774
H. E. Collins. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 83-87. Charts. Notes on the American standard for flanged fittings and tables of fittings.

Standard Symbols for Electrical Equipment of Buildings. 621.3(003)
American Institute of Electrical Engineers Journal, June 1924, v. 43, p. 557. Approved "Tentative American standard," March 6, 1924; sponsors: American Institute of Architects, American Institute of Electrical Engineers, and Association of Electragists-International.

Standardizing Tool Data Sheets. 658.516
A. L. Evans. *Iron Trade Review*, June 5, 1924, v. 74, pp. 1499-1503. Diagrams and description of forms approved by the National Machine Tool Builders' Association.

Technical

American Machinery for Manufacture of Cane Sugar. 664.1
C. A. Handschin. *Western Machinery World*, June 1924, v. 15, pp. 183-186. Illus. Describes implements used by Hawaiian planters for cultivating and harvesting.

Application of Pressed Metal to Pulleys. 621.961
S. G. Gaillard. *Forging—Stamping—Heat Treating*. June 1924, v. 10, pp. 226-229. Illus. Various operations in the manufacture of pressed steel belt pulleys.

Automatic Substations for Industrial Plants. 621.311
Chester Lichtenberg. *Power Plant Engineering*, June 1, 1924, v. 28, pp. 604-606. Illus. Possibilities of the automatic electric substation in the industrial field. Discusses specific operation problems.

Ball Bearings: Their Proper Function and Methods of Mounting. 621.82
F. Johnstone Taylor. *Mechanical World*, June 6, 1924, v. 75, pp. 353-354. Considers thrust, load capacity, cone-type bearings, double-row bearings, and points out the importance of careful fitting and removing of bearings.

Belt Standardization. 658.2621
William Staniar. *Belting*, May 1924, v. 24, pp. 48, 52, 54, 56, 58. A study made by the Du Pont Company to determine the most economical type of belt for each of the 2500 drives in the plant, also a study of transmission machinery. Shows the value of these standards in making replacements.

Best Ways to Use Insulating Varnish. 667.7
H. L. Hazeltine. *Industrial Engineer*, June 1924, v. 82, pp. 284-287, 306. Illus. How to protect windings against moisture, oil, metallic dust, and insulation troubles.

Brakes Used to Retard or Hold Rotating Parts. 621.838
A. J. Whitcomb. *Industrial Engineer*, June 1924, v. 82, pp. 271-274, 304. Illus. Types of electrically operated brakes applied to different drives. Discusses structural detail, installation, adjusting, testing, and maintenance.

Coil Spring Calculations. 684.212
J. W. Rockefeller. *Machinery*, July 1924, v. 30, pp. 874-875. Charts. Three charts used in designing coil springs with explanations and diagram illustrating the method of using them.

Combustion Control for Boilers. 621.1875
R. J. S. Pigott. *Power Plant Engineering*, July 1, 1924, v. 28, pp. 694-695. Requirements of an automatic control system of regulating steam flow, air flow, and fuel feed. Abstract of paper presented before the Metropolitan Section of the American Society of Mechanical Engineers.

Cost of Sheet Steel Punching. 621.96
F. C. Lawrence. *The Engineer* (London), May 30, 1924, v. 137, pp. 597-598. Methods commonly adopted for pricing punchings and alternatives free from their shortcomings.

Earning Value of Power Plant Instruments. 621.171
C. D. Zimmerman. *Power Plant Engineering*, June 1, 1924, v. 28, pp. 596-597. Use and maintenance of meters can save from 2 to 15 per cent of coal.

Economical Cupola Melting. 621.72
H. Van Aarst. *The Foundry*, July 1, 1924, v. 52, pp. 514-515. Illus. Some factors governing fuel economy in the foundry, are the iron to be melted, quality of the coke and air and limestone supply.

Economical Operation and Maintenance of Boiler Furnaces. Part 2. 621.18
R. June. *Blast Furnace and Steel Plant*, June 1924, v. 12, pp. 300-302. Methods of furnace construction, advantages of suspended arches, monolithic baffles, and curtain walls. Shows need for inspection.

Factory and Plant Maintenance. 621.715
A. A. Arnold. *Mechanical World*, May 30, 1924, v. 75, pp. 341-342. Cement, sand, and aggregate, suitable for concrete machinery foundations.

Grinding Practice in Railroad Shops. 621.92
M. B. Richardson. *Railway Mechanical Engineer*, June 1924, v. 98, pp. 345-348. Illus. Increased production and improved accuracy effected by the use of grinders. Tools and operation are described and illustrated.

How Belting Was Standardized in a Large Automotive Plant. 658.2621
H. A. Flogaus. *Belting*, June 1924, v. 24, pp. 19-24. How belting standards were arrived at and reports on power transmitting property of different belts. (To be continued).

Insulating Conditions of Windings. 621.3
Industrial Engineer, June 1924, v. 82, pp. 282-283, 306. Illus. Inspection procedure and cleaning methods before making dielectric tests in alternating current machines.

Mechanical Engineers Handbook. 621(02)
Edited by Lionel S. Marks. 1986 pp. McGraw-Hill Book Company, New York. $6. Divided into 15 sections covering the fol-

lowing subjects: mathematic tables and weights and measures; mathematics; mechanics of liquids and solids; heat; strength of materials; materials of engineering; machine elements, power generation; hoisting and conveying; transportation; building construction and equipment; machine shop practice; pumps and compressors; electrical engineering; and a miscellaneous section discussing measuring instruments, surveying, mechanical refrigeration, lubrication, and American Society of Mechanical Engineers power test code. This volume is a revision of the first edition published in 1916. Contributors to the present work number nearly 60 and all write on subjects with limited scopes on which they may be assumed to have specialized knowledge. There is much information of value to manufacturers contained in the book.

Meter Types and Their Characteristics. 621.1875
C. D. Zimmerman. *Power Plant Engineering*, July 1, 1924, v. 28, pp. 696-698. CO_2 recorders, temperature recorders, and other meters valuable for the determination of data from which boiler efficiency can be calculated.

The Possibilities of Mechanical Painting. 698
J. W. Gibbons. *Railway Mechanical Engineer*, June 1924, v. 98, pp. 360-362. Illus. Sante Fé railroad shops find mechanical painting devices more than worthwhile. Gives brief description of methods employed.

Possible Improvements in Bearing Service. 621.82
G. A. Van Brunt. *Industrial Engineer*, June 1924, v. 82, pp. 264-270, 304. Illus. Advantages and disadvantages of sleeve and anti-friction bearings with comments from manufacturers relating to improvements in bearing operations and recommendations for equipment installation.

Practical Bonus Systems for Power Plants. 621.18
Garrett Burgess. *National Engineer*, June 1924, v. 28, pp. 255-258. Illus. How to obtain greatest boiler efficiency in a plant not operating the entire 24 hours a day and method of determining bonus value of efficiency obtained.

Recent Developments in Gas Works Machinery. 665.7
F. H. Beebe. *Gas Age Record*, June 7, 1924, v. 53, pp. 791-793, 796. Automatic control, elevated generators, waste heat boilers, by-product gas ovens, and gas purification.

Reinforced Concrete in Collieries. 693.5
J. D. Paton. *Iron and Coal Trades Review*, May 23, 1924, v. 108, p. 875. Discusses cement used, working stresses, adhesive values, and other problems.

Sanding Operations Discussed. 621.92
K. H. Lansing. *Abrasive Industry*, June 1924, v. 5, pp. 142-144. Illus. Types of sanding machines used in different plants.

Scrapping Steel Freight Cars. 621.392
A. M. Candy. *Welding Engineer*, June 1924, v. 9, pp. 21-23. Illus. Application of the electric arc cutting process to the reclamation and scrapping of rolling stock.

Slow-Speed Steam Engines for Industrial Purposes. 621.101
D. S. Capper. *World Power*, June 1924, v. 1, pp. 353-357. Individual power plants versus centralized power. Steam power plant may be more economical and more efficient, depending on location of plant.

Some Political Aspects of Super-Power. 621.31003
G. E. Tripp. *Stone and Webster Journal*, June 1924, v. 34, pp. 689-698. Gives main points of the Norris-Keller superpower bill and briefly expresses disfavor.

Stabilizing Gear Manufacturing. 621.83
L. G. Hewins. *Iron Trade Review*, June 26, 1924, v. 74, pp. 1691-1693. Gears can be produced for better service and at lower cost in gear manufacturing than in general plants. Includes brief market analysis.

Standardizing Tool Data Sheets. 621.9
A. L. Evans. *Iron Trade Review, June* 5, 1924, v. 74, pp. 1499-1503. Diagrams and description of forms approved by the National Machine Tool Builders Association.

Where Wiring Can Be Improved Around Machines. 621.3
Industrial Engineer, June 1924, v. 82, pp. 275-278, 281. Illus. Second article on all manner of wiring improvements and safety measures with illustrations of good and bad installations.

Worm Grinding in the Lathe. 621.94
J. W. Armour. *Machinery*, July 1924, v. 30, pp. 859-860. Description of operation with illustration and diagram.

Yarn and Weight Records in Hosiery Mill. 677.66
W. E. Haseltine. *Textile World*, June 21, 1924, v. 65, pp. 53, 55. Illus. Describes method of checking weight of goods as knitted, showing variation from standard. Immediate correction prevents waste.

Transportation

Anything Is Possible When We Have to Do It. 656.4
H. G. Taylor. *Electric Railway Journal*, June 21, 1924, v. 63, pp. 966-968. The advantage of street car over automobile transportation. Urges publicity to educate the public to see this.

Einzelheiten der Elektrahangebahnen. 625.432
P. Stephan. *Zeitschrift des Vereines Deutscher Ingenieure*, June 7, 1924, v. 68, pp. 606-609. Illus. Electrical suspension railroad problems concerning tracks, switches, and cars.

Motor Bus Transportation. 656.124
A. E. Hutt. *Society of Automotive Engineers Journal*, June 1924, v. 14, pp. 591-593. Principles underlying its successful operation. Considers bus design, system of maintenance, operation, spirit of service, etc.

The Virginian Railway Electrification. 625.1:621.33
H. K. Smith. *Railway Age*, June 7, 1924, v. 76, pp. 1353-1358. In order to increase the capacity of this railroad, which is primarily a coal handling one, the management undertook to electrify the portion between Mullens, West Virginia, and Roanoke, Virginia. Briefly describes the locomotives, the plan of operation, the power equipment, and the transmission system.

Wages

Installing Wage Incentive Systems That Work. 658.3225
Earl Beck. *Factory*, June 1924, v. 32, pp. 826-829, 940-943. A bonus system employed in the Indianapolis plant of Eli Lilly and Company, based on standards worked out from studies of the various operations, and the factors entering into them.

Payment by Results. 658.32
By J. E. Powell. 411 pp. Longmans, Green & Co., New York. $7. This exhaustive discussion of management methods of wage payment is based on the author's extensive experience in English manufacturing organizations. The general principle set forth is that success or failure of any particular plan for basing wages on results is dependent largely upon the efficiency of the management—the best plan will operate unsatisfactorily in a poorly managed factory. Methods of remuneration, applicability of payment by results, determination of those results, job rates and upon what they are based, payment of indirect labor based on results, are a few of the subjects discussed in considerable detail with interesting and valuable practical examples taken from the author's experience. Mr. Powell believes that correct estimation of output upon which job rates are based is an essential factor in the success of any wage-payment plan, and he devotes 150 pages to practical suggestions for making such estimates on numerous classes of work. Although based on English practice this book will prove valuable to American wage payers.

Practical Bonus Systems for Power Plants. 658.3225
Garrett Burgess. *National Engineer*, June 1924, v. 28, pp. 255-258. Illus. How to obtain greatest boiler efficiency in a plant not operating the entire 24 hours a day, and method of determining bonus value of efficiency obtained.

Suggestion for a Premium System. 658.32
C. G. Barth. MANAGEMENT AND ADMINISTRATION, July 1924, v. 8, pp. 71-73. Diagrams. Barth wage system with comments on Rowan and Halsey. Workers' time computing diagram is given.

Which Way Are Wages Headed? 331.2(001)
A. J. Hain. *Iron Trade Review*, June 19, 1924, v. 74, pp. 1623-1626, 1638. Charts. Statistics on wage rates for iron and steel industry, railroads and metal trades.

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CONDITIONS AND PROSPECTS
IN
BUSINESS AND INDUSTRY

End of Recession Is In Sight: Signs of Better Business Grow

PREPARED BY LEWIS H. HANEY

Director, New York University Bureau of Business Research [1]

The P/V line in Fig. 1 continued its moderate upward course during July. This is the third consecutive month in which our main forecasting line has risen. While the advance has not been sharp and there is doubt as to the extent of the business recovery which is forecast, there can be no doubt that the outlook for the near future has continued to improve. The favorable forecast made two months ago is, therefore, repeated as applied to a period embracing the next four to six months. This forecast, it should be noted, is not based solely upon the trend of the main forecasting line, but is supported by a consideration of all the data contained in the accompanying charts.

Recent Developments

The most significant developments during July and the early part of August are outlined in the following list, although perhaps the most outstanding feature is the evidence that the bottom of the depression was reached in several basic industries during this period.

1. The general advance in the level of commodity prices (Fig. 12).
2. The increasing purchasing power of large sections of the farm population arising from higher prices coupled with good yields.
3. Rapid progress towards the settlement of the Franco-German problem.
4. The further easing of money rates with continued investment buying.
5. The advance in foreign exchange.

Favorable Factors

Evidences of the beginning of a turn for the better are apparent in the following list, most of the points being illustrated by the accompanying graphs.

1. Continued sharp curtailment of industrial output (Fig. 2).
2. Downturn in the index of stocks of 45 commodities (Table 1).
3. Upturn in wholesale commodity prices (Fig. 12).
4. Increased farm purchasing power.
5. Increase in new business enterprises (Fig. 13).
6. Decrease in business failures (Fig. 13).

To the foregoing may be added the various points made in preceding paragraphs such as the upturn in the main forecasting line and the European settlement, which, as a result of the London Conference, now only awaits ratification. The further easing in money rates is acting as a constructive force.

Unfavorable Factors

1. Continued sharp decrease in the employment and earnings of labor (Figs. 7 and 8).
2. Further decline in building activity (Fig. 6).
3. Mail order sales decreased (Fig. 11).
4. Bank debits decreased (Fig. 10).
5. Unfilled steel orders decreased (Fig. 3).
6. Stocks of basic commodities in first hands still large.

Of the foregoing, the decreased purchasing power of labor appears to be the most serious. Indeed, the decline in unfilled orders, on account of its smallness, might be construed as favorable in

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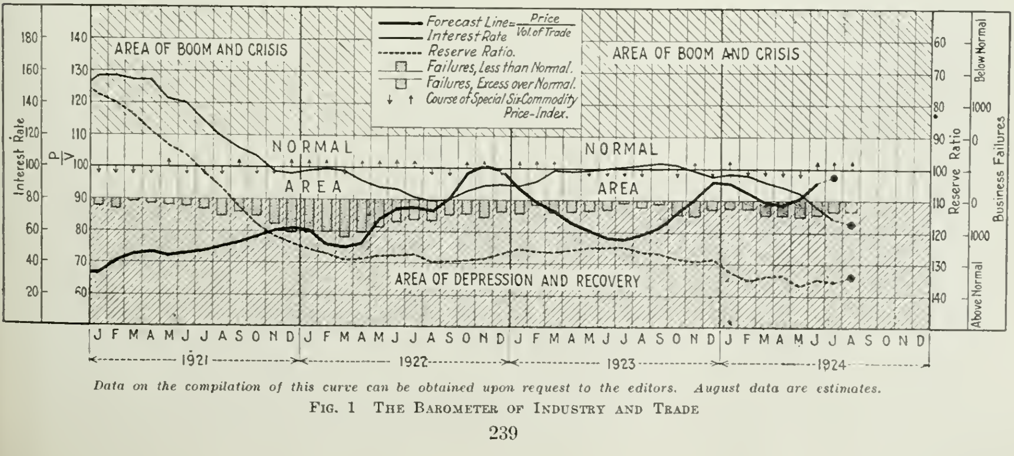
[1] Assisted by Horace J. Barney and R. H. Leding of the Bureau's Staff.



Data on the compilation of this curve can be obtained upon request to the editors. August data are estimates.

Fig. 1 The Barometer of Industry and Trade

a forecasting sense, and the stocks of basic commodities, while large, decreased in June.

FUTURE DANGERS

Among the more general conditions which are so vague as to be difficult to discount at present, may be listed the following:

1. The possibility that the third party may make sufficient headway to put the radical element of Congress in a strategic position. In general, the uncertainties and sentimental setbacks of the election season have to be reckoned with.
2. The complete action and reaction of the European settlement is difficult to forecast, but it should be recognized that some unfavorable effects are likely to emerge. Increased competition from European manufacturers and increased demand for the return of European funds invested in this country are among the possibilities.
3. In connection with the probable increase in European competition, the maintenance of the present high level of wages in this country continues to be a problem.
4. The possibility that industrial activity may begin to advance too rapidly, before the existing heavy stocks of basic commodities are sufficiently reduced to insure a stable market. It would be better in the long run for production in several basic industries either to decline further, or to continue low for two or three months. An extreme illustration of what is meant may be found in such cases as gasoline, automobile tires, and possibly merchant pig iron.

By an improved outlook for the near future is meant a condition in which prices will hold firm or rise, money will be relatively easy, the volume of business will increase, better earnings will appear, and business failures fall off.

The beginning of the business upswing which is here anticipated continues to seem probable about October. While it is believed that the bottom has been reached in several important industries, it is probable that in a large part of the business world the bottom will be touched in September.

Opinions of Business Forecasters

At the present time wide differences exist in the opinions of various business forecasters. Some agree that a major upturn in the business cycle is near at hand. Others hold to a bearish interpretation of events. The difference in opinion is probably good evidence that a turn is not distant. We hold a moderately bullish position and it may be of interest to our readers to consider the more fundamental grounds for that position.

At bottom, business forecasting is based on the assumption of a rhythmical tendency in business activity which is called the business cycle. While there is danger of following this idea too rigidly it must be admitted that the assumption of succeeding ups and downs in business activity is fairly well established. On this assumption most of the evidence indicates that business is now near the bottom of a period of depression and that signs of an approaching upturn are apparent.

Analysis of Conditions

To begin with, there has been a general declining trend in business since May 1923, and this time is nearly long enough to correspond with the probable period of decline in the cycle. There is little reason to expect much further decline in view of the history of recent cycles.

In the second place, numerous symptoms characteristic of touching bottom are found:

Production in basic industries, after a long period of recession, has fallen far below normal and is at a low level with relation to the level of prices.

One of the earliest indications of a turn is often found in a decrease in stocks of commodities, and such a decrease occurred in June.

While this decrease may not be continued in July, it probably marks the beginning of a liquidation in inventories.

Unfilled orders in many lines have reached bottom levels. Unfilled steel orders declined so slightly in July as to suggest an early reversal of trend.

The downward trend of commodity prices has ceased, and all price indexes showed an upturn during July. While this upturn was led by grain prices it would have come if grain prices had been unchanged. For example, in Bradstreet's index, out of 13 groups 10 advanced. Only one of the commodities in our six-commodity index showed a decrease.

Retail trade is at a high level, relatively to wholesale trade. It is usual for this condition to exist at the bottom of business depressions, while at the peak wholesale trade becomes relatively higher than retail trade.

Business failures have shown a pronounced decrease in number.

It is becoming apparent that while some further easing of money rates is possible, the interest rate is so low as to invite speculative buying in all directions.

In fact we are in the midst of a period of investment buying with heavy bond purchases by banks and institutions, going on to stocks and commodities. It is characteristic of depression bottoms to find increases in "securities held by member banks" and a low level of circulation.

At the beginning of an upturn it is common to find advancing stock exchange prices and an increase in new enterprises, which phenomena have clearly appeared during July and August.

For these and other reasons which might be given it seems reasonable to conclude that our position in the business cycle lies at the bottom of a depression and that the immediate changes to be anticipated are those preliminary to a major advance.

Stock Exchange Prices Advance

The condition of the stock market is interesting. At the middle of August there was clearly a period of hesitation following a sharp advance which, as usual, had been carried on too rapidly. The situation may be interpreted most reasonably as resulting from a better realization of the severity of the current depression, a severity which certain business forecasters have minimized. Also there was uncertainty as to the extent of the recovery which may be anticipated, to say nothing of doubt as to when such recovery will begin. It was logical, therefore, for the stock market to pause and await further developments, having discounted the existence of easy money and other known and probably favorable factors.

Extent and Rapidity of Upswing

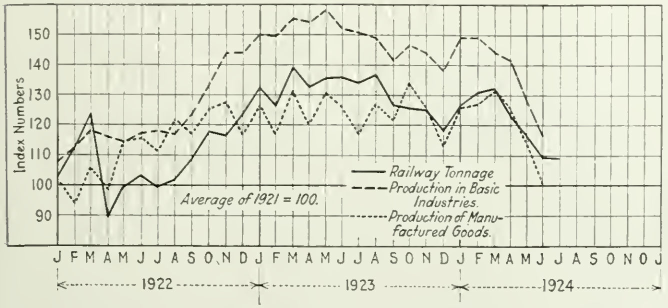
It is yet too early to form an opinion of the extent and rapidity of the coming upswing. Much depends upon the inflation factor, for if considerable inflation develops (as is possible) we may be in for a real boom. If, however, inflation is held in check, the coming upturn may be very moderate in proportion. No forecast is here attempted with reference to the inflationary factor. It is merely observed that extremely low interest and discount rates, heavy reserves, and increasing loans and discounts of member banks, show its possibilities.

A continued upward trend of the stock market is to be expected as the end of the present business recession is clearly in sight. Gains are likely to be moderate until the extent of probable business recovery can be judged.

Production and Stocks of Commodities

Production Dropping in Adjustment Process

Stocks of basic commodities in first hands appear to have reached peak levels and indications of improvement have appeared. The June index of the Department of Commerce, covering 45 commodities, moved down decidedly for the first time this year. July, however, may not show a continuation of the net liquidation of stocks of commodities. The majority of items in Table 1 show an increase, notably gasoline and zinc. Stocks of merchant pig iron increased, but if unfilled orders are deducted, the unsold stocks show a different trend. Stocks of commodities in first hands are still heavy in relation to the volume of business.



Sources, Federal Reserve Board; N. Y. U. Bureau of Business Research. Railway tonnage and production in basic industries corrected for seasonal variation, and the latter also for normal growth.

FIG. 2 RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

Production and Railway Tonnage

Railway Tonnage. The tonnage hauled by Class 1 railways in July was slightly less than in June. The decline, however, was at the usual rate for the season and the adjusted index number as shown in Fig. 2 remained practically unchanged at 109.2, the average for 1921 being 100.

Production. Production of basic commodities in June showed a large decrease which was expected, the drop amounting to nearly 9 per cent. The index is now 116.9 per cent of the average for 1921. Production of manufactured goods also decreased in June, the decline amounting to 12½ per cent.

Conclusion. It is evident that the decline in the physical volume of production has been checked and is now near the bottom. The steady level maintained by the railway tonnage curve in July, allowing for seasonal variation, forecasts an approaching stabilization of production in basic industries. The narrowing spread between tonnage and production indicates that distribution is gaining on production.

Iron and Steel Production

Production. Pig iron production continued to decline in July. The average daily production was at the rate of 57,577 tons as compared with 67,541 for the previous month, a decrease of about 15 per cent. (See Fig. 3).

Production of steel ingots showed a similar decline. The average daily rate dropped from 82,000 to 72,000 tons, a decline of 14.5 per cent. Production is running only 16 per cent ahead of the 1921 average, while the peak in April 1923 showed production 155 per cent above 1921 average. A total of 17 furnaces were blown out during July.

Unfilled Orders. Unfilled orders of the U. S. Steel Corporation declined 75,000 tons. This compares favorably with a drop of 350,000 in the preceding month and over 500,000 tons in each of the two previous months.

Prices. Pig iron prices rose from $19.29 to $19.38 per gross ton, while the composite steel price has declined from 2.589 to 2.517 cents per pound.

Conclusion. The iron and steel industry is trying to be optimistic. Drastic curtailment of production has created a healthy fundamental position. The relatively small decrease in U. S. Steel unfilled orders is indicative of improvement. While buyers still lack courage to place orders for future needs, orders for current requirements are increasing and inquiries for the future are more numerous.

We expect pig iron prices to continue firm and possibly show slight gains during August. September should witness an upturn. In steel we do not look for any material improvement before the end of August. Finished steel price trend has shown a tendency to lag pig iron prices in the current movement. Buying of automobile manufacturers and railways does not indicate an immediate sharp upturn. Continued decline in contemplated construction which forecasts contracts awarded by several months points to a lessened demand for structural steel during the second half year.

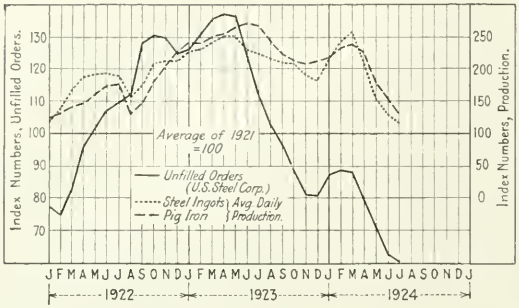
Production in Important Industries

Copper. The June domestic production of copper decreased about 2 per

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH

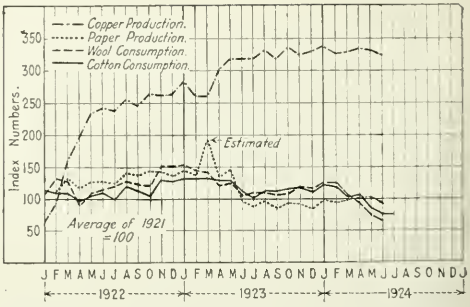
Average for 1921 = 100. Gasoline, raw sugar, cottonseed oil and Dept. of Commerce index adjusted for seasonal variation.

MONTH AND YEAR	GASOLINE	LEATHER (Cattle)	ZINC	NEWSPRINT PAPER	AUTOMOBILE TIRES	RAW SUGAR	COTTONSEED OIL	MERCHANT PIG IRON	DEPT. OF COM. INDEX OF STOCKS—45 COMMODITIES
	100 = 630,757,000 gals.	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,009 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.	100 = 634,950 tons	100 = 132
Jan. 1923	156	85.3	23.6	64.0	105.4	55.0	52.0	35.8	87.7
Feb.	156	84.0	21.5	76.7	107.6	76.0	60.0	43.0	84.1
Mar.	154	82.6	14 1	77.3	119.7	86.0	64.5	44.0	84.8
Apr.	162	81.6	13.0	67.2	129.9	168.0	67.0	38.0	84.8
May	164	81.4	11.6	62.9	139.3	147.0	69.0	41.7	80.4
June	173	82.1	16.9	60.5	159.6	97.0	71.0	53.6	83.3
July	174	82.8	22.2	65.0	161.4	97.0	76.0	72.7	82 6
Aug.	185	83.6	27.5	74.0	148.0	96.2	74.0	97.5	90.6
Sept.	199	84.3	34.4	85.5	138.5	81.8	57.4	111.0	95.5
Oct.	206	84.2	29.6	82.2	123.2	130.4	28.0	121.7	85.5
Nov.	211	85.4	33.4	82.4	111.7	102.8	43.0	131.0	88.4
Dec.	202	85.8	40.3	80.0	107.5	89.8	43.3	141.0	90.6
Jan. 1924	186	87.0	47.3	78.8	99.0	79.0	52.5	145.0	98.6
Feb.	187.5	79.5	52.7	94.6	110.0	54.5	53.5	144.5	97.8
Mar.	188	83.8	48.0	101.0	120.5	90.0	58.5	140.0	98.6
Apr.	203	81.2	41.5	103.0	132.0	143.0	60.2	139.5	98.6
May	197	77.2	42.5	105.6	141.3	125.6	63.2	148.6	102.9
June	214	78.0	54.9	114.9	140.1	99.4	62.4	158.8	95.7
July	220	77.0	64.3	111.4	141.1	108.9	68.2	164.2	.....
Aug.	...	.....	68.3	. ...	.....	.....	..	... .	.....



Sources, Iron Age; American Iron and Steel Institute. All curves corrected for seasonal variation.

FIG. 3 IRON AND STEEL PRODUCTION AND UNFILLED ORDERS



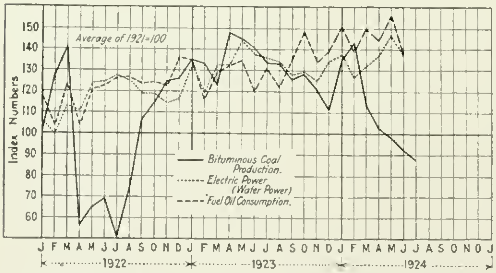
Sources, American Bureau of Metal Statistics; American Paper and Pulp Association; Bureau of Census; Department of Commerce. Cotton and wool curves corrected for seasonal variation.

FIG. 4 PRODUCTION IN FOUR IMPORTANT INDUSTRIES

cent. There is a better outlook for copper demand both at home and abroad and firm copper prices are in prospect with further advances probable. (See Fig. 4).

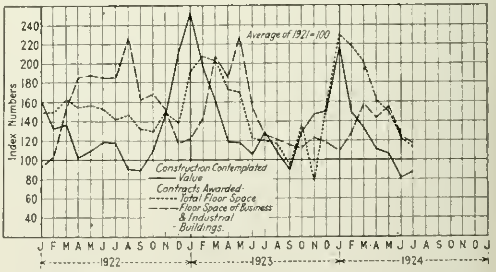
Paper. The June production of all grades of paper as a total was cut decidedly, the decline amounting to 9 per cent and the index standing at 92.8 against 102.1 in May (the average for 1921 being 100). This decline, however, is largely seasonal.

Wool. Wool consumption continued its downward trend with a decrease much sharper than usual in June. The adjusted index was 66.8 against 76 in May, a decline of 12 per cent. The outlook in the woolen industry has improved.



Sources, Department of Interior; Bureau of Mines; United States Geological Survey. Bituminous coal and electric power curves corrected for seasonal variation.

FIG. 5 FUEL AND POWER PRODUCTION



Source, F. W. Dodge Company. Construction contemplated curve corrected for seasonal variation.

FIG. 6 BUILDING CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

Cotton. The consumption of raw cotton by mills decreased a little further in July. Some decrease is usual in that month. The July decline, however, was greater than the seasonal variation, the adjusted index falling from 76.5 in June to 75.4 in July.

Fuel and Power

Bituminous Coal. The output of coal has continued steadily the decrease which began last February. The February index, adjusted to eliminate seasonal variations, was 87.7 against 92 in June (the average for 1921 being 100).

Fuel Oil. The indicated consumption of fuel and gas oils fell sharply in June to an unadjusted index of 138, against 156 in May. (See Fig. 5).

Hydro-Electric Power. The consumption of hydro-electric power in June dropped much more sharply than usual in that month, the adjusted index showing a decline of over 6 per cent.

Conclusion. The fact that in June and July all the indexes of important sources of power fell off more than usual for the season indicates the effects of the current depression in industrial activity. The outstanding fact is the continued large decline in coal production. The index is now near bottom levels and not much further decrease is to be expected. Higher coal prices seem likely soon and purchases may be made at present levels with confidence that better prices are not probable.

Building Activity in July

The downward trend of building activity continued during July.

Contemplated Construction. Contemplated construction showed little change during July. The actual amount fell slightly, but not so much as usual at this season. Accordingly, the adjusted index was slightly higher. The total value of contemplated construction, however, was far below the level in July 1923 or 1922, although greater than in July 1921. (See Fig. 6).

Contracts Awarded. The total floor space in all building contracts awarded during July decreased about 12½ per cent from June. This decrease is partly seasonal, but mostly represents a cyclical downturn in building activity. The floor space in business and industrial buildings decreased nearly 5 per cent.

In comparison with June there were large decreases in building activity in the Northwest, the Central West, and New England. Small increases occurred in the Middle Atlantic States and in the Southeast.

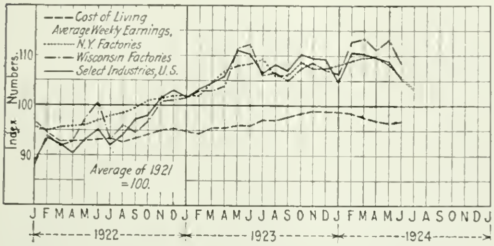
Conclusion. Not only is the trend of business activity downward, but the volume of deferred construction work is abnormally small; consequently there is no probability that the volume of building will be large this fall. Residential building is a smaller percentage of total building, while the percentage of public building has increased somewhat. Both facts indicate the existing depression.

Wage and Employment Situation

Continued Falling Off in Employment and Earnings

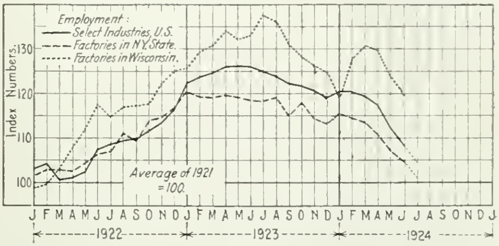
Earnings and Cost of Living

Selected Industries in the United States. On going to press the July figures for earnings were not available. Hence the index number for the graph has been estimated from such data as were at hand. Reports throughout the country show that there has been a decline. There have been some reductions in wages and considerable part time work. This is usual during the summer months. (See Fig. 7).



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin; National Industrial Conference Board. New York and Wisconsin curves corrected for seasonal variation.

Fig. 7. Wages and Cost of Living



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin. All curves corrected for seasonal variation.

Fig. 8. The Trend of Employment

Average weekly earnings fell from $27.21 in June to $27.12 in July. This decrease is less than the normal seasonal variation, and the adjusted index rises 1.8 per cent. (Graph shows estimated drop of 2 per cent).

Wisconsin. The index for June, adjusted for seasonal variation, registered a sharp decline to 108.4 (the average during 1921 equals 100).

Other States. In Pennsylvania per capita earnings decreased 5.9 per cent in July, and in New Jersey there was a decrease of 3.7 per cent. This is without correction for seasonal variation. Ordinarily there is a small decrease in per capita earnings during the summer months.

Cost of Living. In June the cost of living in the United States, as reported by the National Industrial Conference Board, increased slightly. The index is now 96.9 (the average for 1921 equals 100).

Conclusion. While labor's purchasing power has been curtailed during the past few months, the indexes of per capita earnings are still above the average for 1921 and living costs are about 3 per cent under the 1921 level. The decline in the index of per capita earnings in the United States, which is not corrected for seasonal changes, has been due partly to the normal summer decrease. Indications are that earnings of factory workers will not drop much further in the near future.

The Employment Trend

United States. The chart, Fig. 8, shows the estimated decrease in employment, after adjustment for seasonal variation. Exact figures were not available on going to press.

New York State. After adjustment for seasonal variation the index of employment in New York State dropped 3.5 per cent. (The graph shows an estimated drop of 2.5 per cent. Employment in the state has been dropping continuously since February and is now but slightly above the average for 1921. In New York City the employment decline was less than in the rest of the state. Much of the decline here was accounted for by dullness in the women's apparel shops, and the boot and shoe factories of Brooklyn.

Wisconsin. In June, for the second consecutive month, employment in this state showed a decline. The index, corrected for seasonal variation, now stands at 119.7 (the average for 1921 equals 100). This is slightly above the level of January of this year but the downward trend is as marked as in the case of New York State factories, and in selected industries throughout the United States.

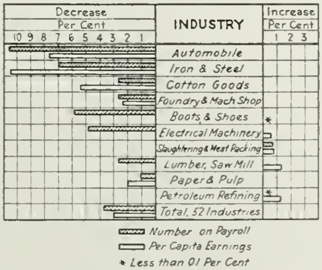


Fig. 9. Trend of Employment and Earnings, June 1924

Conclusion. For the third month all reports indicate decreases in employment. Labor is now working less and earning less, on the whole, than since the early part of 1922. However, employment conditions are not bad and improvement rather than further depression is to be expected in the labor situation this fall.

Employment and Earnings in Selected Industries

In Fig. 9 are shown the changes in employment and earnings of 10 leading industries in June.

Employment. All but two of the industries analyzed showed sharp declines in the numbers of persons employed. The largest decreases were in automobile manufacturing and in the iron and steel industry—these following similar sharp reductions the previous month. Slightly greater numbers of persons were employed in petroleum refining, and slaughtering and meat packing. For 52 industries combined there was an average decrease of 3.8 per cent.

Per Capita Earnings. Although slight increases, ranging up to 1.3 per cent in sawmills, were indicated in five of the industries, the trend was decidedly downward. Iron and steel, and automobiles led with decreases of 10.5 per cent and 7.7 per cent respectively. The average decline in average weekly earnings for the 52 industries was 3.0 per cent.

Immigration and Emigration

No new figures are available on going to press. The latest reports are those for May 1924, published in these pages last month and showing immigration 32,985, emigration 6,634 and the net gain 26,351. As unemployment has been on the increase for several months, no immediate labor shortage is in prospect as a result of lessened immigration.

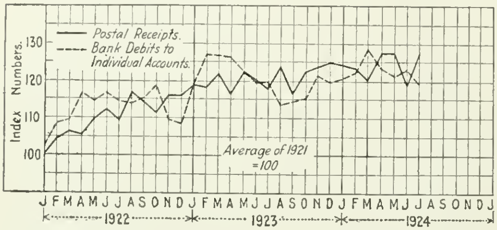
Trend of Trade and Finance

Firmer Prices and Better Trade Develop

Bank Debits and Postal Receipts

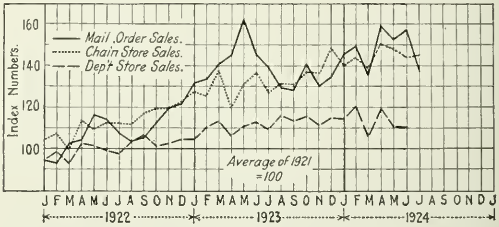
Bank Debits. This important index, which represents the volume of checks drawn, has declined rather steadily since March. In July it reached the lowest point for the year. (See Fig. 10).

Postal Receipts. The actual amount of post office receipts decreased in July, but not nearly as much as usual in that month. Accordingly, the adjusted index rose from 119.2 in June to 127.3.



Sources, Federal Reserve Board; Post Office Department. Both curves Corrected for seasonal variation.

FIG. 10 BANK DEBITS AND POSTAL RECEIPTS



Sources, Commercial and Financial Chronicle; Federal Reserve Board. Data cover 2 mail order houses, 4 chain stores, and 306 department stores. All corrected for seasonal variation.

FIG. 11 SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES

Conclusion. The foregoing indexes reflect accurately the general activity of trade, both retail and wholesale. Business (especially wholesale trade) decreased in July. But it is significant that the level of business holds up so well—about the same as a year ago. With the fall revival near, not much further decline is probable.

Retail Trade

Mail Order Sales. There was a sharp decrease in the sales of the two leading mail order houses in July, the figures falling from 26.9 million dollars in June to 22.1 million dollars in July. This decrease is greater than usual and the adjusted index fell from 157 to 137. (See Fig. 11).

Chain Stores. On the other hand, four of the principal chain stores showed a small net gain in July. Usually in this month the chain stores show little change, and accordingly the adjusted index rose from 143.9 to 145.4.

Department Stores. After eliminating the seasonal variation, the index remained practically unchanged at about 110 per cent of the 1921 average.

Conclusion. This suggests an early resumption of buying by retailers which should result in better volume of wholesale and manufacturing business.

Prices and Interest Rate

Prices. Bradstreet's price index on the 1st of August was 3.4 per cent higher than on the 1st of July. Out of 13 groups of commodities 10 have advanced. The rise is, therefore, not due to grain alone. The index is now 112.1 against 108.6 on the 1st of July (the 1921 average being 100. See Fig. 12).

The special six-commodity index followed up the slight rise in June by a large increase in July, the index for the latter month being 113.1 against 105.5 in the former.

Interest Rate. As expected, the money rate declined further in July, the index of commercial paper falling from 58.1 in June to 52.1. There will be a further decline in the index for August.

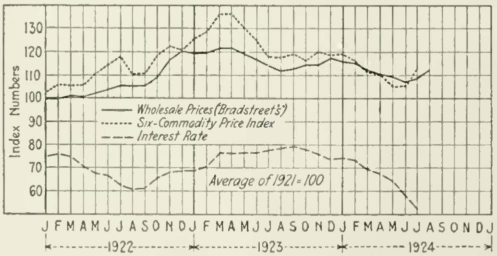
Conclusion. The foregoing is the strongest possible evidence of a favorable outlook for the business future. There has been a general advance in prices with money at bottom levels. Further gains may be expected in the commodity price level, although possibly there will be a period of irregularity. Money will continue easy, with possibly further slight declines in the rate on commercial paper, during the next two or three months.

New Enterprises and Failures

Business Failures. The three months' average shown in the graph declined decidedly in July, making a clear trend towards a decreasing number of business failures. The index eliminates normal seasonal variation. The number of failures in July was 1,615 against 1,607 in June, but normally there should be an increase of over 7 per cent in July.

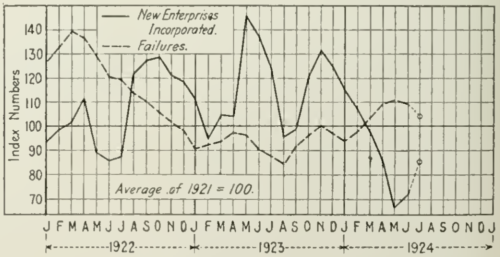
New Enterprises. There was an increase both in number of new enterprises and in their total capitalization. The adjusted index increased from 64.6 in June to 85.3 in July, and the three months' moving average turned up.

Conclusion. The turn in the curves shown in Fig. 13 all but proves that an upswing in business is near.



Sources, Commercial and Financial Chronicle; Federal Reserve Board. Interest rate is the monthly average, corrected for seasonal variation.

FIG. 12 WHOLESALE PRICES AND INTEREST RATE



Sources, Dun's Review; New York Journal of Commerce. Both curves plotted as a 3 months' moving average, centered and corrected for seasonal variation.

FIG. 13 NEW ENTERPRISES AND BUSINESS FAILURES

MANAGEMENT
AND
ADMINISTRATION

VOLUME VIII SEPTEMBER, 1924 NUMBER 3

The Industrial Executive

By B. A. FRANKLIN

Vice-President, Strathmore Paper Company

THE United States of America has become predominantly an industrial country. Still great agriculturally, it has, nevertheless, traveled steadily and rapidly ahead on the industrial road until it has reached even greater industrial development. Its people flock to the cities and to the factories in those cities. The hours of work are shorter than on the farm; the financial returns appear larger; and a wider career, or at least a more interesting and varied experience opens out before the factory worker. These are sufficient constantly to recruit his ranks.

As this process goes on—as the workers flock to the factories—the general standard of living advances to constantly higher levels, and this demands more and more manufactured articles. At the same time the ownership of industry and the interest in it become more and more widely distributed, and the population becomes more and more dependent upon industrial prosperity. And science, invention, the mechanical developments of the last quarter century, the anticipation of greater ones in the years to come, all join in a promise of even greater industrial development than has thus far been seen.

Index Number
658.31242 Industrial executive

How far shall industry go and how best shall the balance between agriculture and industry be maintained? Perhaps the operation of the law of supply and demand, pretty sure but sometimes painful in its processes, may determine. Or the urge of the particular kind of civilization America builds may settle the matter. Certainly the question—though one of the major questions facing the country today—is one that cannot be easily answered. Industry in its own defense may be called upon to help work out a solution of the problem and apply the corrective remedies.

Movement Toward Co-operation

There is a movement, started in Massachusetts by industry, to improve the farm product output through the aid of expert advisers in crop and animal raising and in boy and girl encouragement. This movement, if spread, will add to and aid very materially the fundamental

FIG. 1 VIEW OF THE MITTINEAGUE PLANT, STRATHMORE PAPER COMPANY

wealth of the country. It is a basic addition to the far-seeing idea of co-operation of industry and agriculture.

The tremendous expansion of industry is bringing to greater and greater prominence and importance the profession of industrial executiveship or management, and the qualities, knowledge, and operating abilities of those who practice it.

In the earlier stages of industrial development there were but two clearly defined classes—capitalists and laborers—capital taking to itself, largely, direct management. At the present time industry is rapidly developing three classes—the capitalist, the manager, and the laborer. The future success of industry will unquestionably depend very much on the middle class—on those who constitute the management group.

Spread of Capital Control

Capital is including a more widely diffused group, embracing management, and indeed, in increasing proportion, labor itself. There is being developed a democratization of capital which promises to be the best and only practical solution of the old struggle between capital and labor. Stock ownership in our industries is becoming more widely spread as wealth in America increases, and is seeping down to all those who are willing to exercise thrift. Labor itself, as an organized group, is undertaking the rôle of capital. Capital is becoming a group proposition in which anyone may be a member.

This movement, encouraged by management, initiated here and there in individual units by far-seeing capital, bodes well for industry if properly developed, for no one is so jealous for the welfare of the industrial unit as ownership, or permits so grudgingly conditions which lead to high cost and low production.

There are those who speak slightingly of the capitalistic system as if it were a scheme foisted and forced upon the world by the shrewdness and ability of the few. It is, however, the natural outcome of the development of industry, is essentially right in principle for successful progress, and if it has a bad name it is because those in control have been too few and too selfish—because they have conceived this control as is always the case with new-found powers, as peculiarly a personal affair and not subject to the rights of others.

The wider spread of stock ownership combined with fair management ought to offer to all who contribute effort toward industrial success, just what democracy offers to citizenship—a participation in that success in proportion to the ability of their effort.

The eventual, reasonable, and indeed, from the practical standpoint, the only attainable adjustment of the capitalistic system must come through this wider spread of participation among those engaged in its operation. This is the true democracy of industry. For if any industrial system is to succeed and progress in a democracy, it must be satisfactory to the majority, and not merely be endured as it might be in an autocracy.

This wider spread makes all the more necessary and important the work of management and the industrial executive, because failures and losses with the larger spread cause the wider loss and suffering, which would bring about a lack of confidence, and support would act as a brake on the spread itself.

The lines between capital, management, and labor as intimated, are not sharply drawn in industrial America except as to the active functions of each. As individuals, anyone may belong in two of these classifications, and in practice many do. Time is proving positively, as industry advances in America, that one may readily start in one class, even in the lowest degree, and eventually land in either of the others, even in the highest degree. This is because America is a land of opportunity and individualism, and its industry an invitation to the ambitious and courageous. But even more than that it is because widespread capitalism is the natural and only solution in our form of civilization, of the material side of community life so frequently sought to be solved by the "isms". And this development must depend largely on a highly developed management.

It is hardly conceivable that the capitalistic system should die or be displaced, or even cease to grow. We have seen one country, Russia, make the experiment in one direction to solve both the problems of government and of industry by a great radical move. We have seen other countries court disaster by holding too rigidly to the old ways. Is it not time for America to lead, by peaceful common-sense and technically correct methods, and by the introduction of a spirit and a soul into industry, to the broader and more successful industrial development she has already attained in government?

While the capitalistic system cannot die or be displaced, it may well be broadened so that the benefits of industry may become more widely and equitably distributed. As it is widened, there must be, as there have been, leaders—men of shrewdness and courage—capitalists, but not purely profit-makers so much as men of constructive vision with willingness not only to lead but to share. It is this kind of capitalism which will so commend itself that all fair and ambitious men will support it and avail themselves of its benefits.

Labor must, of course, always constitute an essential part of the industrial system, for without it there is no production. The dreams of very short hours and entire machine production as of approximate attainment are of more harm to labor itself than to any others of the industrial group. For labor there should be fair working conditions, reasonable wages, proper standards of living, continuous employment, education, thrift, insurance, and stock ownership, and in these there should be constant development. On the other hand, they should command from labor full co-operation.

Management a Group Proposition

Management, as it is developing, is also a group proposition, composed of those with initiative, responsibility for results, and authority. In its ranks are found all those who direct and control, from the chief accountant to the storekeeper, as well as from the chief executive to the foreman.

But the heart of management must be the industrial executive. Since the management group includes, as does every group of human beings, individuals of varying ages, experiences, abilities, and temperaments, and as these must act together with definite policy and co-ordination toward a constant and economical flow of calculated results. it follows from the very law of group success that one executive mind, or an organized unit of executive minds, must inspire, animate, and direct the whole group if progressingly satisfactory results are to be obtained.

The far-reaching importance industry has already attained, and its still rapidly developing growth, demand that this one or more men in each industrial unit—forming a large and important group of men in all industry—be composed of the highest class of executive ability.

Speaking broadly. the returns from industrial operation must not only provide for proper maintenance, necessary expansion research, and improvement, but for social welfare of the community, the workers, and the stockholders. The time is rapidly passing when stockholders' profits alone shall be the sole or even the main aim of industrial executives. More and more, men of large vision, wide comprehension. and particularly of a progressive understanding in the aims. methods, and responsibilities of management are needed, not only in the rendering of service to their stockholders but to those who serve with management in all degrees and to the world at large, for business is a service.

Point of View of the Industrial Executive

The industrial executive, then, should be a man educated along the lines of his work—a trained man, a man not only with plans and capable of planning, but with policies and an ability to vision them. And beyond all, he must be a man responsive to the appeals of humanity, who at the same time can make decisions and enforce strict discipline with justice and a fair consideration of service as the basis of his operations. He should be a man with broad outlook to recognize his unit as a service to the public as well as to those engaged in the business itself. This, then, is his job.

But he should also have an insight as well as an outlook, because there are coming to him, constantly, internal problems—questions of processes, practical decisions to be made, personnel matters to be determined, and difficulties and delays, the smoothing out and settling of which make for his leadership.

The industrial executive, when he considers his responsibilities from the broad viewpoint, must primarily look upon industry as a service to the world because without that fact industry would not exist. This very viewpoint is of profit-making value because it compels consideration of qualities, serviceability, extent of use, popularity, price comparisons, and requires also a constant study of products and markets.

This viewpoint also compels a consideration of the policies of the business in relation to competition, trade organizations, financial institutions, government, the community—things that make the outlook of the industry.

On the other hand, the internal requirements of the business compel a consideration of service as it concerns the workers, and the comparative service values of the workers, processes, methods, systems, and especially of the plan of organization.

It is only by a study of the aspects of the business, both of the outlook and the insight, that an executive is led on to the best success for his company and for those concerned. Nothing is so narrowing as to concentrate alone on profit-making. Nothing is so profit-making as to get the broader aspects of outlook and insight and definitely to operate on conclusions drawn from the results of their study.

The Ideal Executive

The industrial executive if he is to develop the true economies of industry in his active practice, must, naturally, have an understanding of them and of the principles on which industry is founded. He must also be far-seeking—a man who, while operating in the present, keeps his eye constantly fixed on the future.

Gradually the principles of scientific management are being understood and the developments of modern industrial engineering are seeping into the practice of many industrial units. But it may not be an unfair statement, that, while many industrial units are successful because of the shrewdness and natural business abilities of their managers. too many industrial executives depend wholly upon their practical experience and common sense—splendid and necessary as these may be—to handle the running situation, and too few have a conception of, or attempt to obtain a clear understanding of, industry as a whole and its detailed principles of operation.

What, then, must the industrial executive be, and know, if he is to be the ideal executive?

There is a need in every industrial unit of an executive who comprehends the significance of industry, its relation in service to the world outside of it, and to the people inside of it, the values of friendly competition and the trends of industry. and from this understanding develops broad policies.

He should have some definite understanding of markets, even of foreign ones, and of advertising—of the methods of informing the world of the service his organization offers.

He should have some definite comprehension of his relation to his community, for upon the character of his community rests not a little the quality and success of his labor.

He should understand and join in those co-operative movements, fairly visioned and managed in the general good, for industrial progress and protection, because it is part of his duty to provide these broader movements and also because their success reacts to the advantage of his own unit.

In every industrial unit there ought to be a clear understanding by the executive of the value of building, maintaining, educating, and inspiring an executive organization. Even in smaller organizations, the best success is to be gained by the co-ordinated effort of a number of loyal and active minds, and, if an industrial unit is to be valuable to the world, this executive organization must be such as will carry it on independently of any one personality.

Industry is not in its infancy, and there is a large amount of important knowledge vastly more applicable to the operation of industrial units than actual practice seems to indicate. What is needed in every unit is at least one executive who will give direction, education, and training, and foster research in those methods and their application to the particular operations of his unit.

Also it is essential in every successful and growing industrial unit that there be a clear understanding of finance and banking; capital relations to production, distribution, inventories; amount of business done to credits and debits. This necessarily involves a reasonable understanding of accounting and especially cost accounting.

There must be, of course, skill in processes and operations, and there is unquestionably need, in more units than now possess it, of a definite and progressive scheme of laboratory testing and research work if qualities and standards are to be maintained and raised. The industrial executive may not be the master of such methods, but he ought to be able to guide and control them.

The Executive's Control

The old idea that the owner or his representative has feudal rights and can justly discharge employees at will is being replaced as being both impractical and unprofitable, by the idea that those who cast in their lot in loyalty and service for the general good are entitled to the fairest treatment as co-partners in the total effort. There is, therefore, no greater need in the industrial unit today than of executives who have some comprehension of the psychology of the situation, and who will handle labor so justly and humanly as to gain its good-will.

This must not be interpreted, however, to mean anything else than that industrial units, to attain success, must be operated as autocracies of ability. The few must plan, and insist upon the intelligent but disciplined carrying out of their plans. Whatever democracy there is in industry, for the worker—outside his right to work or quit—should be practically limited to an insistence on fair working conditions, and some representation in the consideration of what constitutes such conditions.

Now if the industrial executive is to maintain these relations properly he must have, certainly, some general understanding of the economics of industry. In practice, there is a vast inability on the part of industrial executives to explain the economics of the situation in which they operate and believe, and of the economic laws under which they expect their employees to operate happily. Yet the situation demands constant explanation in both word and deed if full co-operation and not forced compliance is to be gained.

Utilization of Operating Economies

Certainly there is a need among industrial executives for a broader understanding and systematic application of the economies of industry. The values to be obtained have been amply shown by commissions and investigations in such matters as standardization, simplification, and reduction of styles. There are, as every engineer knows, great opportunities of economies in balancing and in keeping up to date in equipment, in reducing the daily material production wastes, in restricting labor turnover, and in conservation of labor.

There is also a great possibility of economy in organization concentration—the operation of every man from top to bottom toward the definite results for which the industrial unit is aiming. Nor can the more important economies of industry be satisfactorily obtained except through the methods developed by industrial engineering and the introduction of detailed systems, reports, reward plans, production planning and routing, and constant research methods.

Utilization of Expert Assistance

Industry is distinctly an engineering operation, and if the industrial executive is not an engineer himself—since he must be a business man and there seems to have grown up the idea that he may not always be both a business man and an industrial engineer—then certainly industrial success demands that he must be able to understand, introduce, and control these abilities in his unit.

While it may be hardly expected that any appreciable percentage of industrial executives will be versatile enough to combine in their own persons all the knowledge and abilities of the ideal executive, they can nevertheless have an appreciation of them, obtain the necessary personnel, and inspire and control them.

"Industrial Democracy"

Industry has often of late been threatened with the term "Industrial Democracy". If such a term characterizes a condition of industry in which the workers as a group control and operate it, then industry is in for a bad turn, should "Industrial Democracy" come about, for there does not exist and is not likely to exist among the workers the necessary ability for the broad and successful operation of industry. In America such ability quickly leaves the ranks of labor and advances into the classes of management and capital.

If the term "Industrial Democracy" is intended to convey the meaning that the workers shall be given some voice in their working conditions, and be fairly and with friendliness consulted in the larger scheme of co-operation, and have the opportunity by capital participation to become stockholders, then the term has a reasonable significance, for already in America the worker has the right to choose and change, to rise and own.

In conclusion, if we are to approach more nearly to a scientific management in our industrial units, then our industrial executives must educate themselves, must be familiar with the literature and methods of industry, and must study and train themselves and others along the lines of its broader needs—must in a sense become industrial engineers and see it, as to the public and to those more intimately involved, a service in which there are possibilities of a high career.

If, then, there be added the open, the inquisitive, and the initiatory mind, and a high executive ability with the ear to listen and the will to adopt that which is good, then industry with its rapidly advancing requirements in all phases of its development will gladly absorb and use them in its progress toward world service.

The Southern Industrial Labor Supply

The Piedmont Section of the Carolinas

By RALPH G. MACY

Consulting Mechanical and Electrical Engineer

THE labor situation is one of the main factors that is responsible for the exceptionally rapid industrial growth of the Piedmont section.[1] Previous to this development, this section was agricultural and contained a white and black farming population. These people had just begun to recover from the effects of the Civil War, when the cotton mills were started and the demand came for factory hands. This demand was met mainly by the white farming population of the two states in which the Piedmont section lies. Certain figures pertaining to the population of this section will assist in visualizing the labor situation.

An inspection of Table 1 shows the population of North and South Carolina and the percentage of whites in these states and in the Piedmont section. The high percentage of whites is indicative of the manufacturing activities, as the negroes were not found to be practical for a large part of this factory work.

TABLE 1. SHOWS POPULATION OF NORTH AND SOUTH CAROLINA AND THE PERCENTAGE OF WHITES IN THESE STATES AND IN THE PIEDMONT SECTION.

State	1900		1920		Piedmont Section	
	Population	Per Cent of Whites	Population	Per Cent of Whites	Total Population	Per Cent of Whites
North Carolina..	1,893,810	67	2,559,123	70	1,545,748	71
South Carolina..	1,340,316	42	1,683,724	47	.....	.. ..

The death rate of the states in which this section lies, and the illiteracy, are shown in Table 2. As was pointed out in the first article of this series[2] the death rate for these states, among the white population, is considerably below that of the United States, as the climate and the living conditions of this section are excellent. In illiteracy the figures of 8.2 for North Carolina are somewhat above the average for the United States. However, many of the people of this state are finding employment in mill villages where there are educational advantages, and this figure is being steadily reduced.

In that part of the Piedmont section that is in South Carolina are located the large cotton mills which manufacture gray goods and sheeting, and the large bleaching and finishing plants. In that part which is in North Carolina—approximately two-thirds of the section—are located the cotton yarn mills, the knitting mills, and the tobacco and furniture plants. Table 3 shows comparative figures for the years 1899 and 1919 pertaining to the increase in industrial growth and factory labor for the state of North Carolina alone.

Index Number
38(75) Industries in the South
658.38 Laboring classes

TABLE 2. SHOWS THE DEATH RATE AND THE ILLITERACY OF THE STATES IN THE PIEDMONT SECTION

State	Death Rate, 1921			1921 Average Birth Rate	Illiteracy, 1920		
	Average	White	Black		Average	Black	White
North Carolina	11.3	9.9	14.4	33.8	13.1	8.2	24.5
South Carolina	11.3	9.8	14.6	29.5	18.1	6.6	29.3
United States..	11.7	....	....	23.7	6.0	.. ..	. .

TABLE 3. COMPARATIVE FIGURES FOR THE YEARS 1899 AND 1919 PERTAINING TO THE INCREASE IN INDUSTRIAL GROWTH AND FACTORY LABOR FOR THE STATE OF NORTH CAROLINA

	1899	1919	Per Cent of increase
Number manufacturing plants......	3,465	5,999	72
Number of wage-earners	72,322	157,659	117
Wages paid...	14,051,859	126,753,000	802
Capital employed . ..	68,283,005	669,144,000	871
Value added by manufacture .	40,419,859	416,102,000	931
Value of products.	85,274,083	943,808,000	905

The main industries of this section are the manufacture of textiles, tobacco, and furniture. In Table 4 are given the figures for these industries for the state of North Carolina—with the exception of textiles, for which the figures for South Carolina are also given.

TABLE 4. SHOWS THE FIGURES FOR TEXTILES, TOBACCO AND FURNITURE—1922

Industry	State	Wage-Earners	Value of Product	Per Cent of Manufacturing Plants in Piedmont Section
Cotton goods...	North Carolina.	78,972	229,670,691	80 per cent of spindles
Knit goods....	North Carolina.	12,564	27,352,354	
Textiles.......	South Carolina	61,382	180,218,686	
Total...	. ...	152,918	437,241,731	
Tobacco..... .	North Carolina.	16,449	214,830,000	98
Furniture.....	North Carolina.	8,697	30,288,781	80
Miscellaneous..	North Carolina.	40,714	149,368,476	44

The number of employees engaged in the manufacture of textiles is shown in this table, and an idea of the importance of this industry to the section can be obtained by comparing this figure with those showing the number of wage-earners in the other industries.

In this section there is still a large farming population, and it is interesting to note from what parts

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[1] Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION for May 1924, p. 517; June 1924, p. 663; July 1924, p. 47.

[2] See MANAGEMENT AND ADMINISTRATION for May 1924, p. 517

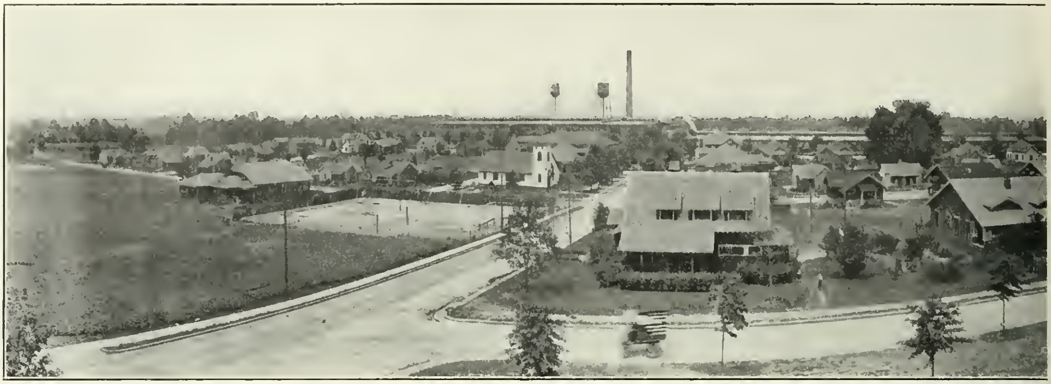

FIG. 1 VIEW OF A MILL VILLAGE SHOWING HOUSES OF

of these states were drawn the large numbers of operators required by the growth of the textile industry. There are no large cities in this section to draw upon—only two cities, Winston-Salem and Charlotte, having a population between 60,000 and 75,000—and these cities are more the effect of the industrial development than the cause. In fact, the mill-owners tried the experiment of locating the mills on the outskirts of cities and depending on them for their operators. However, the urban population did not seem to care for the work in the mills and the owners were forced to build mill villages in order to be assured of a steady labor supply.

The Piedmont section is located just south and east of the Blue Ridge Mountains and among the many benefits which have come to this section from these mountains are the hill people, who have lived there for many generations and are of pure English stock. The conditions under which the majority of these people lived were not desirable and in many cases there was actual poverty. Therefore, when the textile mills of the Piedmont section wanted labor, they had no difficulty in securing it. By the building of modern mill villages with electricity and water in the houses, and with paved sidewalks and streets, they created an environment that was in decided contrast with the primitive conditions under which these people had lived in the past. The houses in these villages are constructed of wood or brick on concrete piers and are of the bungalow type with shingle or clapboard finish. Some idea of the construction of these mill villages can be obtained from Fig. 1. They are rented at from $1 to $1.25 per room per month which, in many cases, does not pay the carrying charges—as the construction cost ranges from $1500 to $2500 per house. Some of the mills have constructed different types of houses, and as an operator progresses in the mill, he becomes entitled to a house of a slightly better type. This is said to have an appreciable effect on the initiative of the operators.

Schools for the children of the operators are built and maintained, and the teachers are employed and paid by the mills. The curriculum which is taught is that required by the state in which the mill is located. Fig. 2 shows one of these schools, and they are the equal of those maintained by the municipalities of this section. In the villages are welfare houses presided over by Y. M. C. A. secretaries. (See Fig. 3). They are the center of social activities, and dances and moving-picture shows are given. These secretaries are paid by the mills, but are under the jurisdiction of the national body, and by this management they have the advantage of the various experiences of the other secretaries working in different parts of the section, possibly under slightly different local conditions. There are also playgrounds for the operators, and one mill has a park in the mountains of about 2500 acres some 25 miles from Greenville, South Carolina, where the operators can go in the summer. Medical attention is given the employees in case of accidents, which are usually of a minor nature. Fig. 4 shows an outdoor swimming pool of one of the Y. M. C. A. buildings built and maintained by a mill. Instruction is given in hygiene and in cooking when desired, and it is sometimes essential for the maintenance of the health of the operators.

This care is undoubtedly reflected in the cordial relations existing between the owners and the operators. The small outlay required for fuel and warm clothing due to the short and mild winters, and the opportunity to grow their own vegetables, are responsible for a considerable difference in value between the dollar of the southern and the northern operator. David Clark of the *Southern Textile Bulletin*—who is an authority on the textile situation—stated that the southern operator could live as well on $18 per week as the northern operator could on $21.50. There is also a considerable difference in the standards of living and the amount of money spent for non-essentials.

In North Carolina 60 hr. of work a week is the maximum allowed by law, and in South Carolina 55 hr. per week. Children under 14 years of age are prohibited from all work in the mills. These hours do not appear to be a hardship in any way. The tenant proposition makes it a simple matter for the operator to reach the mill, there being no time lost in walking or riding to work.

There are some 700 cotton goods mills in North and South Carolina containing approximately

Bungalow Type Built of Wood or Brick on Concrete Piers

11,000,000 spindles, and 80 per cent of these are in the Piedmont section. The mills employ over 140,000 persons, and in Table 5 are shown the numbers of men and women and the rates of wages received.

TABLE 5. SHOWS THE NUMBERS OF MEN AND WOMEN EMPLOYED IN THE MILLS AND RATES OF WAGES

State	No. of Employees	No. of Males	No. of Females	No. of Children	Highest Paid		Lowest Paid	
					Male	Female	Male	Female
North Carolina.	78,972	46,324	27,754	4,894	$4.75	$1.87	$1.83	$1.63
South Carolina.	61,382	39,648	18,498	3,200	Average Male $2.12		Average Female $1.68	

As can be seen from Table 5, the percentage of female labor in terms of the total labor employed is over 30 per cent in South Carolina. By far the greater part of the textile industry of this state is in that portion which lies in the Piedmont section, and it is here that most of the gray goods and sheetings are made. The figures for North Carolina show that the percentage of female labor to the total labor is over 35 per cent. and this is to be expected as in the central portion of the section which lies in North Carolina, most of the yarns are produced, and in this work a higher percentage of women are employed.

The figures in this table for North Carolina are for the highest and lowest average daily wage paid to males and to females, and when children are mentioned it means those under 16 years and over 14 years of age. These figures are not obtainable for South Carolina, but the average daily wage has been given. This was calculated from the total amount paid the wage-earners of the state.

Practically all the operators in these mills are white. Several attempts were made to use the negro labor, but they are said to have been distinct failures. The negroes in the mills of the south are employed as firemen in the boiler-rooms, for the cleaning of the plants and the miscellaneous heavy work.

The system of pay is on a piece-work basis with but few exceptions. As the rate of pay increased during the war and after to a figure that the mill-owner realized could not be maintained, they stated the advance in an increased percentage of the old base rate. To this was added a certain per cent for unbroken attendance and for punctuality. In some mills, the rate is still calculated on the old base, and when the rate declined after the war, it simply meant a reduction in the percentage that was added to the established base rate. There is very little bonus or premium pay, with the exception of that given for regular attendance, as stated above. In the majority of mills, the wages are paid weekly, the others pay semi-monthly.

There does not appear to be much attention paid to the keeping of records with regard to the maintenance factors such as absenteeism, tardiness, and labor turnover from the standpoint of plant efficiency—except in a very general way.

The nearness of the operators' homes makes tardiness extremely rare and absenteeism due to illness is immediately investigated and rectified by proper medical attention. The labor turnover during the last few years has been steadily decreasing. During and after the war when the mills were working on large orders, some of the mill organizations would endeavor to obtain skilled labor from the other mills. This practice has been discontinued as the resulting disorganization of the labor market worked to the detriment of the entire section and this condition was soon recognized by the mill-owners. Also the slacking down of the mills since 1919 and 1920 has eased the labor market to such an extent that such practice is unnecessary.

The union question has not yet become a factor approaching the importance that it has attained in the textile industry in other parts of the country. The mills in the Piedmont section are, in the majority of cases owned and managed by the local people. Large numbers of the operators are local people and those that have been brought from the hill country are not over friendly to the people from other parts of the country. This makes it an extremely difficult situation for the union organizer or agitator. Being a tenant proposition, many times the mill-owners must operate the mills regardless of the demand for their products—in order that the operators may have the necessities of life. The operators being local people are familiar with the condition, and it has assisted in the cordial relation that exists between the employer and the operator at this time. One of the most important factors of all is that over 98 per cent of the people in this section are American born of American parents who have lived in one locality for generations.

The knitting mills are located mainly in the northern part of the Piedmont section. In these mills, more attention is paid to the maintenance factors and general plant efficiency. Many of the operations require a large element of skill and there appears to be no excess of labor in this branch of the textile industry. This is more readily appreciated when there is taken into consideration the rapid expansion in the manufacture of knit goods in the Piedmont section. The majority of these factories are located in cities and many of the employees do not live in mill villages. In Table 6 are shown the number of employees and the average daily wage, which is based mostly on piece work.

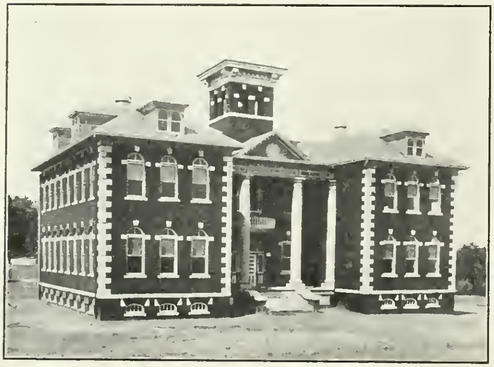

FIG. 2 SCHOOL BUILT AND MAINTAINED BY A MILL

TABLE 6. SHOWS NUMBER OF EMPLOYEES AND DAILY WAGES IN KNITTING MILLS—1922

No. of Employees	No. of Males	No of Females	No. of Children	Highest Paid Male	Highest Paid Female	Lowest Paid Male	Lowest Paid Female
12,564	4,239	7,676	646	$5.02	$3.14	$1.89	$1.38

This table shows the preponderance of women in this branch of the textile industry. In many cases, the knitting mills are located in the cities where there is a demand for male labor. Under these conditions, there is a balanced demand for the employees of both sexes. This is also advantageous for the various industries. These factories are of modern construction, have excellent restrooms, and are well lighted. Medical attention is provided when required and everything is done to make the working period agreeable.

The labor situation in the tobacco and furniture factories is similar to that in the knitting mills. In general, they are located in the cities in the northern part of the Piedmont section.

The tobacco industry has several extremely large plants. In Winston-Salem where many of the knitting mills are located, one of the tobacco plants employed some 10,000 persons in 1922. As Winston-Salem, according to the 1920 census, had a population at that time of 48,395, this meant that practically one person out of five was employed by this concern. In Table 7 are figures pertaining to this industry for which the yearly pay-roll was $14,027,661 for 1922.

TABLE 7. GIVES NUMBER OF EMPLOYEES IN THE TOBACCO INDUSTRY IN 1922

No. of Employees	No. of Males	No. of Females	No. of Children	Highest Paid		Lowest Paid	
				Males	Females	Males	Females
16,449	9,610	6,657	162	$5.14	$3.07	$1.91	$1.48

TABLE 8. SHOWS NUMBER OF EMPLOYEES AND DAILY WAGES IN FURNITURE FACTORIES—1922

No. of Employees	No. of Males	No. of Females	No of Children	Highest Paid		Lowest Paid	
				Male	Female	Male	Female
8,697	8,334	274	89	$5.00	$2.58	$1.91	$1.18

In the cities of Winston-Salem and of High Point are located the furniture factories. The labor situation as in the tobacco industry is more comparable with that which exists in a northern manufacturing city than with the tenant proposition of the cotton mills. However, there are exceptions, and one of the large factories located on the outskirts of Winston-Salem, found it advisable to construct homes for its employees. This factory has changed piece work to daily wages and is finding it an extremely satisfactory proposition. In Table 8 are the wage figures for the industry, and this table also shows the preponderance of men which is a considerable contrast to the labor demand of the knitting mills where women employees outnumber men.

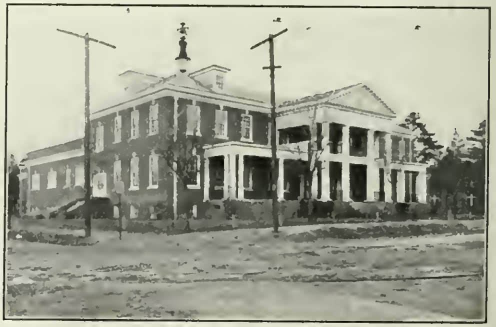

FIG. 3 Y. M. C. A. BUILDING BUILT AND MAINTAINED BY A MILL

For the business and factory executive and particularly for those having mechanical training, there appears to be an excellent opportunity. In the textile industry there are but a few sources in this section to draw upon, the chief being North Carolina Agricultural and Mechanical College, Georgia Institute of Technology, and Clemson College of South Carolina.

Many of the graduates of these institutions, being familiar with the textile mills from early youth, do not find the interest in this line of work that they do in some unexplored field and so enter other industries. The building of many new mills in recent years and the retirement of the older managers and superintendents have created many opportunities for trained men. A number of these mills which were constructed 10 to 20 years ago, were started by local merchants, business men and bankers who did not realize, at that time, the value of technically trained men. However, as many of the manual operations became the functions of machinery with a corresponding increase in importance of the power element, men who had a definite technical knowledge were in greater demand. With regard to the executive branch of the industry, the preference is given to those men who are familiar with the southern mill operator, who is different in many ways from the foreign employee in the northern mills, and who must be handled in a different manner.

The rapid expansion of the furniture and tobacco industries also has created a demand for executives, but this is not so large when compared with textile manufacturing, as these industries employ but a small percentage of the labor required in the textile mills.

With the rapid growth of the industries of this section there is an increasing demand for machinery, electrical equipment, and supplies. The sale and installation of these articles and the construction of new plants increase the demand for technically trained men. In the coming decade there will undoubtedly be many opportunities for this type of executive in the Piedmont territory.

While the people of this section welcome northern capital they do not appear to want northern or foreign labor. There are some 227,000 people over 15 years of age engaged in farming. They are of American birth and parentage and a certain portion is available for industrial labor. The farm environment has made them appreciate property rights and they have a knowledge of the value of a dollar. They are proud of their state and locality and with their high native capacity should make excellent industrial workers. As with the hill people, it will be extremely difficult for the union organizer to obtain control of these people, as they are exceptionally independent. A great deal of the extensive welfare work done by the mills, and the building of pleasant homes, streets, and so forth, appear to be partly due to an endeavor by the mill-owners to make the factory work attractive to this source of labor. When the hill people now available are added to the possible labor supply from the farming populations, there is enough potential labor in sight for the mill-owners to feel that any importation of northern or foreign labor would be extremely unwise. If this is taken into consideration, the potential labor supply with the labor now employed in the cotton mills, tobacco plants, furniture plants, and the various miscellaneous industries places the Piedmont section in an enviable position. The rapid growth of the last few years which has attracted considerable attention to this section of the Carolinas appears to be but the beginning of the establishment of a prosperous and important manufacturing center, which in certain industries, will probably not be excelled by any other section of the United States.

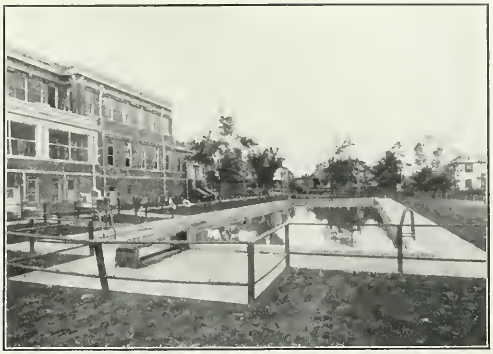
FIG. 4 Y. M. C. A. BUILDING AND OUTDOOR SWIMMING POOL

What Industry Expects of the Public School

By E. H. FISH

THE continued existence of industry as now organized depends on the education of employees in two ways—to make them understand the problems of the owners and managers, and to give them expert knowledge of the various trades. It is a question which is the more important. We have found it possible to get along with very little of either, but it is not hard to foresee a time when ignorance may make it impossible to do business at all.

The public schools are charged with the duty of educating both rich and poor. But they do not appear to have made much headway teaching either of the above essentials. Very few of the thousands of teachers know anything of either.

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6(07) Industrial education

The public schools are carrying more and more pupils further in school. High school enrolment is constantly growing in proportion to the pupils in the lower grades. But after all, it is a question whether the high school helps the industrial situation at all.

Manual training, instituted years ago at the instance of industry, has become purely educational and not vocational. It is frankly not intended to train artisans. There are so few trade schools, and they teach so few trades, that their effect on the whole problem is almost nothing. The shops that offer trade training do so on a selfish basis. They drop learners when the first sign of business depression is seen, and few try to teach boys about industrial relations.

What can be done about it? What part ought industry to take in education, or rather, what part will it have to take for its own self-defense? It is easy to suggest that employers get themselves elected to school boards. It can be done and is done, but with what results? The employer becomes submerged in the greater body of aspiring politicians who are using the schools as a stepping stone to municipal jobs.

Influence of Public Educators

In the first place educators are highly organized. A school superintendent does not act until he knows that he can secure the moral backing of men whose names are so large in educational circles as to overawe any mere layman. Usually these men do not realize the seriousness of industrial unrest, and its reactions on pupils, and even teachers. In the end the big foundations, Carnegie and Rockefeller, decide what is to be taught, even down to the elementary schools, but they do not appear in the question as it comes to the local school committee. So when an employer enters the school committee he does so alone. He has no backing from other members of industry, because industry has no program to offer. In fact, he is usually without a program of his own.

A unified national program is necessary. There is little to be gained by reforming the school system of one or two cities. Neither is the problem one for each employer to handle inside his shop in his own way. Training as carried on in many shops merely feeds other shops. A boy who has stuck to one shop three or four years, by every law of boy nature must get out and be a "journeyman" in a literal sense. The investment which the shop has made in him goes with him to some other shop. Without mutual co-operation the shops which train boys lose them and get nothing in return except the satisfaction of having set a good example to others.

What does the child need? What does industry need? Are the two compatible? How much do they overlap? The school curriculum is already overcrowded. Will it be necessary to add to the confusion already existing in the child's mind?

Essentials of a Practical Curriculum

Every child is entitled to a working knowledge of the English language, as it is used today. The way Shakespeare used it is a luxury to be added to his education if there is time. He is entitled to a working knowledge of arithmetic sufficient to enable him to do the simple computations of every-day life. He ought to be able to make change, add up a column of figures, calculate interest and discounts, and use the tables of weights and measures. Ability to figure interest in pounds, shillings, and pence is an additional educational luxury. Algebra is another. Probably it is one thing on which more time is wasted in proportion to the benefits acquired than any other. Higher mathematics has little place in the education of any except the few who plan to become engineers. And there have been engineers who had a very limited knowledge of calculus.

He ought to have a knowledge of the Constitution, of the methods by which this country is governed, and of its ideals. He should know enough of other forms of government so that he can judge for himself whether his chances for happiness are better in or out of America. In spite of Ford's dictum that history is all bunk, he should know the history of this country and its relations to the histories of other countries. However, until someone writes a history which gives at least as much emphasis to progress in agriculture, commerce, and industry as it does to wars, it will make little difference whether the subject is studied or not.

Geography he needs, though a great deal cannot be taught from textbooks, but must be supplied in up-to-date form by the teachers.

These seem like very simple things, yet how many persons use more in their whole lives? Beyond this there is the technical knowledge of the vocation which affords him a livelihood. Whether this be brick-laying, law, boot-blacking, or architecture, this is a sufficient body of general knowledge on which to build. A few must secure more mathematics. Some must be acquainted with foreign languages. Some must know more of this or of that, but the time to begin to specialize is when aptitudes begin to show.

There is not a fraction of the danger in getting a boy started toward some goal which he later changes, that there is in getting him into some dead-end occupation when he has to begin to earn a living. A boy who goes into something that has possibilities of future advancement, and learns to work, will not find it difficult to change his objective. Half of an education lies in the learning of fundamentals that are common to everything, and a large part of the remainder comes from the efforts a man makes to teach himself.

Shifting of Vocation

Take the roster of the graduates of any engineering school. The number of vocations and shades of vocations in which the graduates are earning a living far exceeds the number shown in the catalog. No college graduate need fear to enter any vocation that he desires, for lack of education or training. He can learn all that he requires for any one vocation in a very short time. He needs only to consider his personal limitations, his health, his disposition, and his likes and dislikes. The uneducated man cannot make these shifts from vocation to vocation without a considerable loss, and yet, of a hundred workmen picked at random on the street, at least 75 will tell of having partially learned more than two vocations.

But no matter which branch of industry a boy may decide to enter, there is always the need of teaching him what might be called shop economics. Economics of production depends on the same fundamental principles as does any other means of securing a livelihood. There should be no difficulty in making it plain.

Cannot industry co-operate with the system of public education to secure men trained not merely in the material things of production, but also in the economics of business and an understanding of its problems?

Economic Factors in Industrial Plant Location

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DECIDING upon the best location for a new industrial enterprise in the United States today is a problem of real significance. It is not alone a question of the new enterprise. New locations for old-established industries are being considered, as changed conditions, affecting either production cost or transportation facilities, make profitable operation difficult. The necessity for the lowest possible ultimate cost of manufactured articles is leading plant designers to scan closely every factor. Location is one of the factors, which is of considerable importance.

Influence of Country's Growth

The problem is complicated by reason of the piecemeal growth which the country experienced during its developing years. The eastern centers had attained extensive proportions as producing centers while yet large areas in the interior were being settled and developed as agricultural producing regions. That condition gave rise to a transportation system designed for long-haul traffic. The freight rate structure grew up in a way to fit that system, favoring the already established manufacturing cities. In time the concentration became too great. To provide for great masses of population brought a severe tax on the railroads, so great became the average distance between producer and consumer. The ton-mileage of freight per capita has become excessive, and it is increasing approximately as the 2.8 power of the population. The situation presents a serious problem in fundamental economics as well as one in the specific field of the individual manufacturer who helps pay the high rates.

Development of Transportation Centers

The first step in the process of readjustment resulted in the creation of a group of cities between the Alleghanies and the Mississippi River. They were at breaking points in the transportation systems, chiefly from water to rail. All of them are now confronted with problems incident to the great bulk of through traffic. In the earlier days it was the ambition of the city builders to gather the railroads into the center of towns and develop great terminal and transfer yards. The concentration of traffic appears to have brought gratification. But in more recent years the growing rail business has brought congestion. In one important manufacturing city in this group, the through traffic constitutes 85 per cent of the total tonnage handled in the terminal yards, and the handling capacity of local business would care for only two-thirds the output of the factories and shops if all were operating at capacity. The great volume of through traffic comes from the concentration of industry in the Eastern cities, calling for constantly increasing movements of foodstuffs and materials, including fuel, to the East, and manufactured commodities to the West. In this way the Eastern centers affect those in the intermediate group, checking the development of the latter in producing activities by abnormal traffic demands.

The second step is a natural outgrowth of the condition just described. Manufacturers are finding many advantages by seeking locations in smaller towns, more widely scattered, but they encounter disadvantages as well, arising from another form of transportation difficulty. This is the matter of freight rates. The old rate structure is based on a plan which fostered the original industrial centers. The newer centers, located at transportation breaking points, became in turn basing points in the rate system, by a natural process. But no such natural breaks occur under the present rate system, when the scattered towns throughout any region are under consideration. The rate structure is not sufficiently flexible. Under it, the roads are unable to break away from the conditions which have caused the trouble. Large cities are suffering from a development under a rate system which built them up, but which has not been adjusted to give them relief when the limit is reached. The result is inefficiency and increased costs. The combination of low production cost and favorable transportation cost is not possible in many cases. Decentralization is being impeded and population masses held at long distances from centers of food production, with resulting increases in long haul traffic and continued congestion at through and terminal traffic points. Vast sums are being spent to remedy the congestion, but the primary causes are not being treated adequately. Development in the scattered communities cannot proceed to a satisfactory degree under the handicap of freight rates. Only as conditions become bad in the large centers is there a sufficient margin to overcome the handicap, and this means that the final cost is excessive.

Change in Rate Structure Proposed

A change in the basic rate structure is being urged in government circles. If it should be brought about many industrial changes would result. Any new system is destined to embody the principle of a terminal charge plus a distance factor, and the abandonment, at least in part, of the old base-point provision. This will affect the location of old industries as well as new. It will be an effective decentralizing influence to reduce the growth in the per capita traffic of the country at large.

This is not intended as an argument either for or against a change in the freight rate structure, but only as a statement of what may become an important influence on the locating of industries. A plant may be located at the best possible point under present conditions, but under conditions which may be brought about later such location may prove to be far from the best. The prospect of change makes it evident that location problems will be viewed with increased interest in the future. It is to be expected that a more logical distribution of industries will result—logical, that is, with respect to the economies of combined production and distribution under transportation conditions such that goods will move to more definitely prescribed markets.

No Industrial System of Distribution

The fact is that this country has no industrial system in respect to distribution. As has been pointed out already, the original plan, if it may be called a plan, was based on the long-haul principle. This broke down quickly as development proceeded. Now there is a mixture of the remnants of the long haul and of heterogeneous elements which have influenced locations. Materials, power, and isolated markets have had positive influence on many industries, but these have been superimposed on a transportation plan which is not in harmony with the other elements and which has the direct effect of increasing the amount of traffic beyond necessary figures. In discussing location matters it becomes necessary to distinguish between adaptations to the present order and a plan harmonizing with an industrial system developed in a more logical manner. Practical procedure must of necessity recognize the existing order, but it is interesting to observe the characteristics of a more complete plan.

A National Industrial System

Distribution of population forms the basis for any system of industrial localization. The Wellington Doctrine of economic railway location, in which combined production and distribution costs are a minimum, must be the standard.

We are confronted at once with the fact that if industries had developed in accordance with this plan, the distribution of population would be different from what it is today. This comes mainly from the transportation policy which has been followed. Railway development policy has fostered the large manufacturing centers, until finally the limit has been reached, and even passed in many cities. There has been disruptive competition between rail and water routes where there should have been co-operation and development on the plan of one supplementing the other. Lowered rail rates to compete with water routes have added to the traffic expense of communities away from the line of parallel operation. Inland communities have had to make up the losses which the low rates on competing parallel lines have brought on the roads. This has meant that cities and industries a little way off from water routes have suffered rather than benefited from water-way improvement. It has had a marked influence on population distribution in the country at large.

However that may be, the existing distribution of population must be accepted and the system developed on that basis. Such a system must be formulated with full consideration of the following conditions:

1. The existing railroad net for the country as a whole.
2. A freight rate structure, modified from the present one in a manner recognizing the distance element in service rendered.
3. Utilization of the natural avenues of traffic—inland water, rail, and auto transport—to be developed on a co-operating rather than competitive basis.
4. Recognition of the influence of food supply and distribution on the cost of living and hence on production costs.
5. Sources of raw materials entering into products of all kinds.
6. Sources of power and of fuel.
7. Systematic analysis of the conditions of production and distribution as a basis for the location of industrial enterprises.

The ideal condition is realized when commodities are produced at points from which they may move readily to the consumer, and reach the consumer at minimum cost. This is the Wellington doctrine. Both production cost and transportation cost are involved. But throughout the combined processes there appears the item of labor. Wages constitute a large portion of the total cost. Back of the wage scale is the cost of living, in which figure the costs to the worker of food, shelter, and clothing. If there is unnecessary transportation in supplying workers with food, then there is unnecessary cost of food and increased wages as a result. The calculation of production cost, when made on the basis of such a situation, fails to take into account all of the facts. The individual producing enterprise cannot assume a differential in wages to result from action taken by that enterprise alone, but we are now talking about a generally revised system. Were industrial workers distributed over the country in accordance with the food producing activities, there would result a material decrease in the transportation cost of food when compared with present conditions. The attendant advantages of fresher and better food in maintaining the health and producing powers of workers can hardly be expressed in financial terms, but they are of significance.

Problems of Agriculturists

Another circumstance comes into the problem here. Growers of staple foodstuffs are confronting a serious difficulty. Their combined producing and transportation costs are becoming excessive. They feel keenly the pinch of high freight charges. There can be but one result, which is still higher cost of food at large population centers. Could the amount of transportation be diminished, even though the rate cannot be, coming from a better distribution of population so that more food would be consumed near the source, then the grower would have readier markets, his income and purchasing power would be increased, and the wage scale for all workers checked in its tendency to rise.

Savings in freight charges are not the only ones possible. Unnecessary transportation is a waste, but not the only one. Food itself is wasted under existing conditions. Preserving it, to make possible its shipment long distances, becomes an added expense. Actual loss from decay is a heavy tax. The whole system of food distribution has become complicated and expensive, requiring the services of many workers in what are truly non-productive activities.

Proposals for Remedying Conditions

Much serious thought and effort is being devoted to means for ameliorating the difficulties and ill effects of the present system. The usual recourse is that of adjusting and readjusting freight rates in the endeavor to check the rising cost of food. This is on the principle that low value commodities, and vital demands for certain others, furnish occasion for lowered rates in order to facilitate the movement. This is a species of artificial tinkering with the rate structure. The history of transportation, since the days when the simple long-haul system was in effect before the decentralizing process began, has been one of patching up the rates in order that certain necessary articles may move in proper quantities. Such adjusted rates do not pay the cost of service. The deficiency must be made up by excessive charges on other commodities, which calls for more patchwork. An objection frequently made to any plan for controlling locations of industries is that it would be an artificial process, out of harmony with the automatic operation of economic laws; but no more artificial measures can hardly be conceived than this one of tinkering with rates, which has been going on throughout the history of the railways.

As a matter of fact, a modified freight rate structure, in which length of haul would have more definite weight, would have the effect of moving industries nearer to their natural marketing areas. Probably no other measures, artificial or otherwise, would be necessary to produce the decentralization required to accomplish, in substantial degree, the purpose of moving considerable portions of population nearer the sources of food supplies. This would not be tinkering, or an artificial adjustment, but a regularized procedure. It is not an easy task. All commodities could not stand the same proportioning factor applied on the mileage scale. But the principle is one that would operate to produce the effects indicated.

Results of Modified Rate Structure

All of this means that under a decentralized plan of distribution of industries the wage scale would vary, somewhat in accord with the cost of living. This is not contrary to present facts as they exist at points where definite progress has been made in building up small manufacturing centers. Its effect is felt in production costs, where it serves to offset any disadvantage arising from smaller quantity of output or excess power cost. In some types of industry the advantages of large-scale production would be greater than such savings, which is another way of saying that some forms of manufacturing call for establishments from which distribution would continue over very large areas, even over the entire country sometimes. It is not to be assumed that a consideration of the food supply as affecting wages, together with the stimulus of a modified freight rate structure as influencing shipping cost to markets, would always mean the carrying of industries to smaller towns. It would mean a considerable amount of shifting, however.

It is notable that every discussion along these lines recurs again and again to transportation. Transportation is the key to all industrial progress. It has been remarked that a basic element in a true industrial system is the full utilization of all natural avenues of traffic. Railways, waterways, and truck haulage on established highways should be merged into a co-operating system. The practice of giving railway rates to meet waterway competition on parallel lines is destructive to the realization of advantages of low cost water transportation. For illustration, much has been done to secure improvements to navigation on the Missouri River between St. Louis and Kansas City. As fast as the river tends to figure in traffic, lowered rail rates on parallel roads go into effect. The roads must recoup their losses by increased rates from those two chief centers to neighboring territory away from the river. The result is that no one outside those two cities derives any benefits from lower traffic costs. Furthermore, development of the river traffic is prevented because the roads are allowed to carry the goods at competing rates, and no advantage comes in the way of increased facilities. The result is concentration and traffic congestion at the large cities. The government grants of improvement funds go merely to enhance the interests of the two cities alone.

Effects of Present Rate Structure

The opening of the Panama Canal has resulted in lowered transcontinental rates for through traffic on the railroads, from centers of the East near enough to the Atlantic ports to make possible the shipment of goods, first eastward to ports, and then by water to the Pacific points. The roads recoup by holding to high rates in the areas far enough west to make the combined eastward rail and water movement impossible. High local rates in this western country make more improbable the chances of bringing more people into closer contact with the food producing activities which are especially prominent there. This is one of the influences which tend to increase the burdens of the farmer of the Middle West, and to create the menace of increasing cost of living for the entire country. Freight originating in this great western territory is made to bear both its natural burden and also the burden of making up the deficiency of revenue incident to low competing rates on long-haul traffic. The latter burden is not a direct imposition on regional lines, but it is an inevitable result, shared with local traffic of all parts of the country.

A scientifically developed plan of traffic co-ordination is essential to a true industrial system established on a nation-wide scale. Only through such a plan can the country realize the full benefit of its natural waterways and its coastal shipping. This does not mean that rivers should be improved at great cost, unless economic conditions justify it. Correct analysis is as necessary here as elsewhere. Railroads should be operated in a manner to supplement the water routes, when the latter are of real significance. The present tendency to discriminate by rates against commodities moving by water for a portion of the distance must be abandoned. The United States Coal Commission, in its recent report, went on record in positive manner on this point. In a similar way there is opportunity for the auto-truck to supplement the railroads as gathering agencies for freight within restricted areas. The radius of action of the truck has not been demonstrated accurately, but with the improvement of highways it supplies a much-needed conveyance for many kinds of freight. The more extended development of the sectional container, by which handling between the truck and railroad car is expedited and cheapened, will add much to the benefits of the co-operative system.

Effect of Change on Industry

The net result of all this will be the lessening of the cost of transportation locally, and within the comparatively short distances. The reduction will be both absolute and in comparison with long hauls under the present system. In general, the long hauls would be more costly than under existing rates. Goods destined for export would probably be allowed a favoring differential. Manufacturing possibilities then would rest squarely on the basis of production costs and the availability of the necessary raw materials. The same analyses which determine economic locations under the present system, which are elaborated in another section of this article, would be applied under the hypothetical conditions of the ideal system. The lines would be more definitely drawn, however. Labor costs would appear with more specific differences in different localities. Overlapping of marketing areas would be reduced, and a material saving in sales expense would be realized.

The discussion along these lines more or less Utopian need not be extended. The major points of difference between a system of industry under a transportation plan of the kind suggested, and existing order, have been outlined in brief form. We may now pass to a treatment of the various factors which influence location, wherein actual conditions govern, with the understanding that the only differences in analysis are those having to do with quantities and the relative degrees of influence, rather than differences in kind.

Factors Which Influence Location

Those elements which have the most direct bearing upon the selection of the most advantageous point at which to locate an individual manufacturing plant are:

Market, with respect to situation, population, purchasing power, consuming capacity, established trade lines, and natural resources indicating future growth.

Materials, supply of actual material entering into the manufacturing process, or accessibility along developed transportation lines when it is a case of fabrication in transit.

Transportation, considered chiefly in respect to rail connections at various possible locations, through which the marketing area may be reached.

Labor, with respect to available workers, their types and characteristics, suitability and experience, nature of other industries, prevailing wage scales in the various branches of industry, social tendencies.

Civil Enterprise of communities under consideration, touching such matters as city planning and zoning regulations, sanitation, housing, workers' residence districts, schools, churches, community activities, and local transportation.

Power, Lighting, and Water, considered as to capacity limits, rates, quality of water as affecting process needs; available fuel in the region, freight rates on coal; other service utilities, such as gas, sewer systems, and street railways.

Distribution Cost, related to transportation but considered from the standpoint of freight rates from possible locations to representative points in the market area.

The interests of the promoting company and of the consumers are mutual. The plant should be at the point where it has the best chance for success. Only as this is accomplished will all parties be best served. Rival towns seeking the establishment may present various advantages, but usually one will prove to be the best. To determine which one is the problem. To do it requires analysis of all elements, weighing each against the others. Personal preferences should be eliminated, at least until after a careful survey has established the facts.

Methods of Approaching the Problem

There are several bases on which the question may be approached. One is that of the company with an established business, now relocating its plant or establishing a branch, which has in view a fairly definite marketing area wherein the controlling volume of business is to be done. This is to be dealt with as the typical case. Another is that of a company, or municipal promoters, wishing to place an industry in a particular city, for which a favorable marketing area is to be chosen. Still another is that of city promoters, having in view a tributary marketing area in which trade lines are already established, who are looking for some industry that will fit the conditions. In other words, there are three determinable quantities—the industry, the city, and the market. Two of these must be assumed at the start and the third found by analysis. The typical case assumes the industry and the market, to find the city. The second assumes the industry and the city, to find the market. The third assumes the city and the market, to find the industry.

Market analysis is the first step in the survey of location possibilities. Immediately two types of industries present themselves. One plans to sell in all parts of the country, and perhaps to export as well. The other has a specified region in view for at least the major development. The concern which has been selling to the general market may now be establishing a branch to handle the business in some region. This last condition imposes certain considerations which are special, but in general the extent of territory makes no difference in the methods to be followed in the analysis. The aim must be to determine the extent of business and its distribution geographically, and the exact character of the product which will meet market needs in case it is an article susceptible to modification. Trends in business development and tendencies to change the fundamental character of basic activities must be considered with care.

Basis for Estimating Demands

The basis on which to estimate quantity demands varies with different kinds of product. Food products, drugs and cosmetics, shoes, and many others are related to population. Clothing of different kinds depends upon population, racial and occupational characteristics, and climate. Heavy wool underwear has a different demand in the Northern regions than in the Southern. Active industrial life creates a demand for work clothing. The stage of progressive development in highway and other construction activities affects the consumption of cement and other building materials. Growing commercial pursuits, building up of cities, and insurance regulations affect the demand for metal office furniture. The population ratio must be modified often in estimating the consumption of articles which normally are related to population, as with drugs and cosmetics among the colored people of the South. Changes in fashions and customs are well-recognized influences on extent of demand. One would expect to sell machine tools in regions where metal manufacturing is a well-developed industry; automobile accessories in some proportion to the number of automobiles in proportion to population; and coal tar dyes among textile manufacturers. A different type of agricultural machinery will be sold in the wheat fields of the West than on the farms of New England.

Process of Organization

A small industry dealing with a correspondingly small trade territory is concerned with established connections of the wholesale house handling the usual lines of groceries and dry-goods. The habit of trade is one on which to build. Retailers and individuals in the district are accustomed to look to the distributing center. The experience of wholesalers and jobbers will yield useful information respecting buying practices and reliability in the handling of accounts by the purchasing public.

While studying the market territory, the form of sales organization to be employed, and a selling policy, must be developed. This involves decisions as to the selling system, whether direct to customer, direct to retailer, through jobber, established branch houses for stocks at strategic points in the territory, or special representatives at such points. All this depends in part on the transportation lines, as also on the importance of the leading towns as wholesale centers. The whole territory must be mapped in detail to bring out the salient features. On the map relative densities of population and of activities affecting the extent of demand should be indicated by some graphical method.

Materials affect plant location with varying degree of emphasis. Some industries are bound to the source of major raw materials. Cement and other ceramic products are good illustrations. Low value commodities cannot move far previous to fabrication. For such it is mainly a question as to whether a plant at a given point of origin of the shales is justified by markets and other conditions pertaining to production costs. On the other hand, certain other industries naturally follow the market. The raw materials in this case are of nature such that they can be shipped at low cost as compared with the finished product, and, provided fabrication cost is reasonably low at the point in question, they should go in the raw form as near as possible to the point of distribution to ultimate consumers. Shoes, paper boxes, and many other light and bulky products represent the group.

Importance of Products to Location

Many other products are more or less neutral as to location, in respect to origin of materials. Other conditions govern. The transportation lines are of special significance, and comparative rates on material coming to the fabricating points must be studied in connection with the rates on product passing on to market. Where the material is itself purchased in the open market, it is necessary to safeguard the enterprise against fluctuations in prices wherever possible. The larger the volume of material handled in such a market, in proportion to the amount purchased by the individual manufacturer, the less will the enterprise be affected. Thus a corn products plant desires to be at a large corn market, so that its own demands for corn will not make up so large a portion of the total that the price is affected by it, or corn growers become able to manipulate prices through restricted shipments. The exact reverse of this holds in the case of condensed milk plants. These plants take milk contracts at rates below domestic consumers' rates, and they need to be at points where their own demand regulates the price; that is, away from large cities.

Changes in the arts of production react sometimes on the question of location from the materials standpoint. In the leather tanning industry in the earlier days the extensive use of natural bark tannage caused the plants to seek locations where bark was readily secured. With newer processes, in which there is more extended use of extracts and special preparations, this tendency is largely counteracted. Perfecting the processes of the by-product coke industry is destined to change radically the price and availability of coke for metallurgical uses in the Middle West, and thus bring about greater activity in foundry and machine shop work in that region.

Transportation is an element of controlling influence. It may be said to be the one thing around which the whole problem of location revolves, excepting for the effect of human motives and attainments. Practically every discussion of the several factors returns to transportation as the point on which they turn. In a preceding section where the characteristics of an ideal national industrial system were being considered, it appeared that the issues were almost entirely dependent on changes in railway policies and railway freight rates. Still more along the same line will be developed in the treatment of the cost of distribution to come later.

It is not necessary to wait for a sweeping modification of the freight rate structure, to institute certain changes in rates which would help materially in bringing about desirable results. The rapid increase in traffic demands was cited in the opening paragraph. If continued for many years more this will mean a greater burden than the roads can bear, and further construction of new lines is not promising under prospective financial conditions. Excessive transportation is a waste and a tax on everybody. Decentralization of industry is the line of approach to a lessening of the burden. There are many rates in effect yielding revenues per ton-mile of freight carried, which are inconsistent with other rates of return. All of the peculiarities of the system, which have tended to build up congested centers where adequate service cannot now be rendered, do not need to be preserved. Changes are possible—changes calculated to remove some of the handicaps to production at points better situated to meet the needs of considerable areas. One much needed modification is greater liberality in granting commodity carload rates on goods originating at intermediate points. When rates are repressive they do not yield revenue to the roads. Greater revenues are possible when the goods are enabled to move in quantity.

Example of Present Rate Inequality

To illustrate this last point, manufactured harness moving between two points both situated between the Missouri River and the Inter-Mountain region is charged almost exactly the same rate whether in broken lots or by car load. The same harness coming from Eastern points is given a commodity rate. If the car rate between the two points were reduced to a figure more nearly representative of the relative cost of service, even though it remained at a ton-mileage rate considerably higher than the through rate from the East, there would be business for the road on that haul yielding greater ton-mile revenue than that received for the through haul, and manufacturing would be stimulated with all of the advantages accruing from the building up of population at the intermediate points. Adjustments of this kind are possible on a large scale and would accomplish the aim of decentralization without necessary lessening of the revenues of the roads as a whole. The effect on localization of industries would be marked if such modifications were to be made consistently.

The illustration serves to indicate the lines into which a study of any location problem must extend, whether the existing rates remain unchanged or not. Frequently it is possible to put through negotiations with the traffic departments of the roads to secure commodity rates of this kind. Greater liberality in the practice should be urged. In studying the distribution policy for a given marketing region, the securing of commodity rates to designated points will effect the selection of centers of distribution to which goods may be moved in carload lots for local distribution. Thus does the transportation element enter into the problem of location in a specific way.

Labor is an element which has had more to do with localization of industries than has any other, save transportation. Inherited and acquired characteristics are powerful influences. The locality which has a large reservoir of labor can furnish workers for new establishments and so provide a form of immunity from one of the worries which come to every promoter of a new enterprise. It provides the quantity element. Whether it does as well in providing the element of effectiveness and low cost of production is another question, which is being answered somewhat differently in many heavily developed centers in recent years than it was under former conditions.

Problem Requires Study

It is not the intent to set up here an argument for decentralization, frequently as has that matter come into the discussion. It is a foregone conclusion that many careful analyses of location problems will result in favor of large centers, especially on the score of production cost. But the matter must be faced candidly and one must draw from the experience of many. There are numerous owners and managers of manufacturing plants who are today looking outside the large cities for favorable locations. Transportation difficulties explain this in part. Labor troubles explain it in part. No doubt the attitude of workers in crowded communities has changed, in ways which affect their effectiveness. The overpowering influence of the large city is not good for many who have gone there through force of necessity to find work, many of whom would have preferred the small town had there been earning opportunities. Immigrants are crowded into segregated quarters in ways that are not favorable to the development of American ideals. The situation does not promise well for the progressive development of the nation as a whole. The task of distribution of the necessaries of life has become great, building up an army of service forces engaged in essentially non-productive labor which is an overhead on production cost.

Scope of Problem

The individual industrial manager cannot count this surcharge on production in its full significance. For him labor cost is a specific thing, set according to conditions as he finds them. In many cases he will find truly that in spite of his desires for a location in the purer atmosphere of the small town he *must take* the course dictated by facts which show economy in the acceptance of the city location. The general problem is social in scope and character. It is the telling argument in favor of a modification in the basic freight rate structure which would remove some of the handicaps of the smaller city. It must be viewed in that larger sense and rest for action on governmental agencies.

THE conclusion of "Economic Factors of Industrial Plant Location" will appear in an early issue of Management and Administration. —The Editors.

Establishing Material and Parts Control

Building Tractors Under Scientific Management—IV

By GEORGE D. BABCOCK

Manufacturing Executive, Holt Manufacturing Company

We have been dealing, up to this point, with the importance of the human element on production. Both the material and mechanical methods used in the plant are important, but material control is perhaps more so. Excellent machinery and methods of the highest precision are entirely useless if the material wherewith to work is absent.

The system of material control developed at the Holt plant depends primarily upon the production program adopted by the executives of the company, based on the expected demand for product. The expected demand for a given period is plotted by months, and from this the manufacturing program is laid out. (See Fig. 18). This manufacturing program shows the number of tractors that must be completed each month. It does not follow the sales program, since the material is put through the shop in lots, and there is a minimum size of lot which it is economical to manufacture. Furthermore, as the demand is somewhat seasonal, an adherence to the sales program would overtax manufacturing facilities at one time, and leave the shop short of work at others.

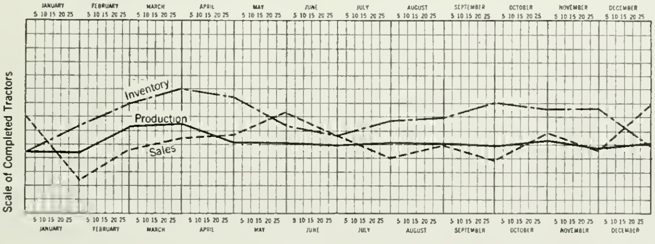


FIG. 18 CHART TO SHOW THE NUMBER OF TRACTORS THAT MUST BE COMPLETED EACH MONTH

It is desirable to build up the supply of tractors sufficiently in excess of the demand at the early part of the program to supply the demand in excess of manufacture at the peak of the sales program, and then to decrease manufacture gradually as the sales fall off, so that there will not be an excessive inventory at the end of the program. This permits manufacture at a fairly uniform rate over a large part of the program. The changes in pace are effected by varying the intervals between lots started in the shop.

TABLE 1. SCHEDULE FOR CYLINDER FOR A TRACTOR ENGINE

	FINISHED TRACTOR	ASSEMBLY	MACHINE SHOP	ROUGH STORES	PURCHASE	ENGINEERING
Number of days in department.... ..	0	22	24	17	60	10
Working days ahead of completion.. .	0	22	46	63	123	133
Date work should be finished..........	July 1	June 5	May 7	Apr. 7 [1]	Feb. 7 [2]	Jan. 25

[1] Date on which invoice should be paid.
[2] Date on which purchase order should be placed.

Index Number
658.9:629.113 Tractor manufacture. Management
658.78 Material control

The manufacturing program is scheduled on the basis of the dates on which the first tractor of each lot is to be delivered by the shop. This fixes the date on which material orders must be placed. Every part entering into the finished product is analyzed; and the number of days, prior to the date of delivery on which the various events in the progress of the part will occur, is found. The production schedule for each part is laid out on the basis of this analysis. Table 1 is typical of the information that is necessary to the scheduling of a part for a lot of tractors on which deliveries must begin on July 1.

Note that this is a part that requires a long time to procure. As a matter of fact it is the longest time part at present in the tractor assembly. This part then fixes the minimum time for the production program. That is, since 133 working days (approximately 5 months) must elapse after the engineering department releases the design before delivery of finished tractors can commence, production of each lot must be planned that far in advance. A similar schedule is laid out for every part of the tractor.

The material control department takes the first steps of actually initiating production. When the manufacturing program has been authorized, the material control department is responsible for making certain that the material necessary to carry out the program is available when and where it is needed. The stores ledgers are the key to the situation. These show, when a program is authorized, the exact quantity of each kind of material on hand in the storeroom, the quantity that has been ordered, but not delivered, how much of the material has been apportioned or reserved for work in process, and the balance that is available for future orders. When the program for tractors is authorized, the material control department first examines the stores ledgers to ascertain what material must be purchased. The operation schedules made up by the route and equipment department, as explained later, fix the date upon which such material is due in the plant for each part, and this is the guide to the material control department for the placing of purchase requisitions.

One fact that must be known is the length of time that must elapse between the placing of purchase orders and the delivery of material. The purchasing department makes constant and careful studies of this question, and keeps the material control department informed of any changes in delivery times on any class of material. A table similar to Table 2 is compiled showing the time that must be allowed to procure the more commonly purchased items, and this guides the material control department as to the date of placing purchase requisitions with the purchasing department. These purchase requisitions show the delivery date demanded, and tickler memoranda coming up from time to time prior to this date enable the material control department to bring increasingly severe pressure for delivery on the purchasing department, as the date approaches on which deliveries should begin.

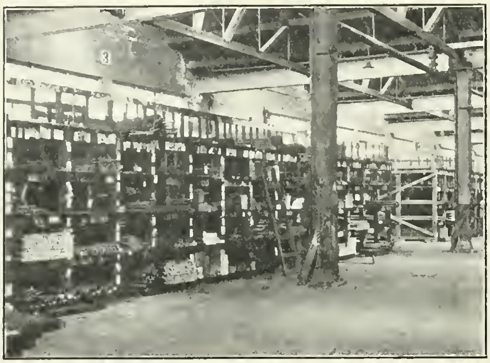


FIG. 19 VIEW OF STEEL RACKS IN STOREROOM

The receiving-room, which is also under the material control department, is advised by means of a duplicate of the purchase order, of the quantity and specifications and the date upon which it should receive materials requisitioned. These, upon arrival, are checked for quantity and turned over to the inspection division for examination as to quality, as discussed later. Material which is accepted is then delivered to the storeroom accompanied by a bin tag showing the quantity delivered.

One or two entries that are made upon the ledgers, purchase requisition, and bin tag, greatly facilitate the handling of purchased material and its flow through the shop. The material symbol and location symbol are the first of these which serve to identify the material and to show its location in stores. All classes of material stored are assigned a permanent location in the storeroom, which is noted on the stores ledger sheet. Fig. 19 shows steel racks in the storeroom. When purchase requisitions are issued, the location symbol for the material is noted on them and this is transferred to the purchase order. The receiving-room notes the stores symbol and location symbol upon a bin tag, so that upon the arrival of material in stores it may be placed immediately in the location assigned. The purchase requisition also shows the date that material covered by it is due in stores. This date is noted upon the stores issue tickets, which are written at the same time as the purchase requisition for a manufacturing order, and which are used as tickler memoranda for following up the purchase order. The unit cost on the ledger sheet is transferred to the purchase requisition to serve as a guide to enable the purchasing department to compare quotations with the cost of previous lots. This figure also permits inventory values to be taken from the stores ledgers with a minimum of clerical labor and expense. (See Fig. 20).

The material control department is advised of the receipt of material in stores by means of appropriate notification slips upon which are entered transportation charges as obtained from the traffic department, and the quantity accepted. From these slips the appropriate entries of quantities and values are made on the stores ledger sheets.

When the stores issue tickets are made out in accordance with the manufacturing schedule, the date upon which the material is due in the shop for the first operation is noted on them. After material which is due on a purchase order has arrived, the tickets are filed in a tickler file to come out on the date on which the material is due in the shop, on which date the tickets are sent to the storeroom as authority to deliver this material. A duplicate at the same time is sent to the dispatchers as a notification that the material is due and that the work orders for machine operation should be posted.

As material is issued from the storeroom, the quantity issued is noted upon the bin tags, and the quantity remaining in the bin should at all times agree with the quantity shown as on hand on the bin tag and the corresponding entries in the stores ledger sheet. These quantities are verified by actual counts of the material in the bins from time to time. This procedure renders a physical annual inventory of material unnecessary. Fig. 21 gives a view of the storeroom showing bins with bin tags attached. Fig. 22 gives

TABLE 2. APPROXIMATE NUMBER OF WORKING DAYS TO BE ALLOWED FROM TIME PURCHASE ORDER IS PLACED UNTIL STOCK IS RECEIVED.

COMMODITY	ALLOWED FROM WAREHOUSE	TIME FROM MILL	
		Average	Maximum
Black iron pipe	10	90	120
Black sheet steel	10	60	90
Bright cold rolled shim steel	10	60	90
Cast steel castings	...	30	45
Cold finished steel—hexagon	10	60	90
Cold finished steel—round	10	60	90
Cold finished steel—square	10	60	90
Cold rolled steel	10	60	90
Cold rolled steel selected to size	10	60	90
Drill Rod	10	45	60
Drop Forgings	...	40	60
Felt	...	20	...
Galvanized iron pipe	10	90	120
Galvanized sheet steel	10	60	90
Malleable iron castings	...	45	60
Mild steel flat	10	60	90
Mild Steel plate	10	60	90
Mild Steel round	10	60	90.
Mild steel shapes	10	60	90
Raybestos brake band lining	...	30	48
Rubber hose	...	30	60
Seamless copper tubing	...	60	90
Seamless steel tubing	10	45	60
Seigelite packing	...	20	30
Shim brass	20	90	120
Soft iron wire	10	...	...
Specification alloy steel	...	60	90
Specification carbon steel	10	60	90
Yellow bar brass	20	90	120

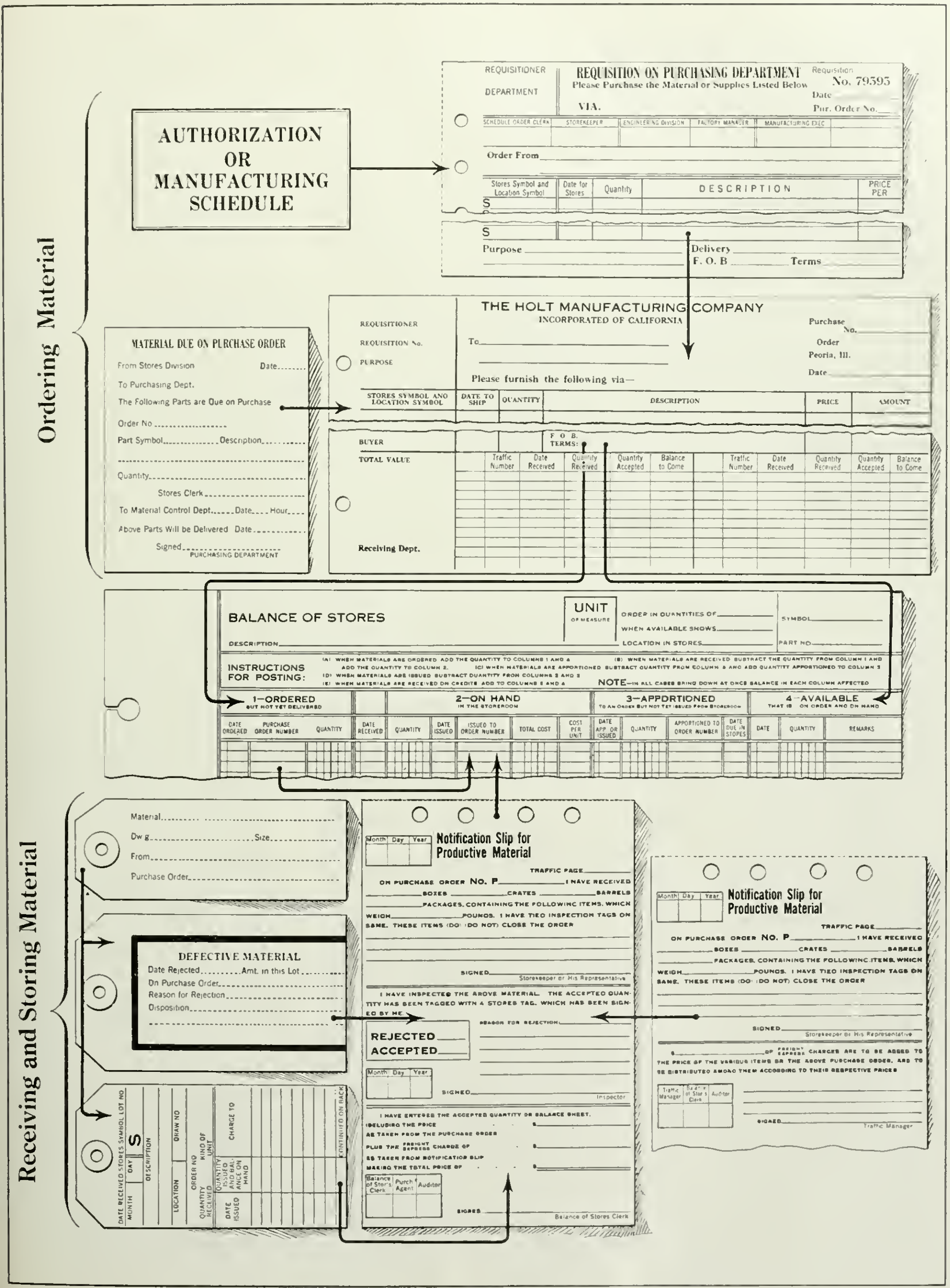

Ordering Material
Receiving and Storing Material
AUTHORIZATION OR MANUFACTURING SCHEDULE
REQUISITION ON PURCHASING DEPARTMENT
Please Purchase the Material or Supplies Listed Below
REQUISITIONER
DEPARTMENT
Requisition No. 79595
Date
Pur. Order No.
VIA.
SCHEDULE ORDER CLERK
STOREKEEPER
ENGINEERING DIVISION
FACTORY MANAGER
MANUFACTURING EXEC
Order From
Stores Symbol and Location Symbol
Date for Stores
Quantity
DESCRIPTION
PRICE PER
Purpose
Delivery
F. O. B
Terms
THE HOLT MANUFACTURING COMPANY
INCORPORATED OF CALIFORNIA
REQUISITIONER
REQUISITION No.
PURPOSE
To
Please furnish the following via—
Purchase Order No.
Peoria, Ill.
Date
STORES SYMBOL AND LOCATION SYMBOL
DATE TO SHIP
QUANTITY
DESCRIPTION
PRICE
AMOUNT
BUYER
TOTAL VALUE
F. O. B. TERMS:
Traffic Number
Date Received
Quantity Received
Quantity Accepted
Balance to Come
Receiving Dept.
MATERIAL DUE ON PURCHASE ORDER
From Stores Division
Date
To Purchasing Dept.
The Following Parts are Due on Purchase
Order No
Part Symbol
Description
Quantity
Stores Clerk
To Material Control Dept.
Date
Hour
Above Parts Will be Delivered
Date
Signed
PURCHASING DEPARTMENT
BALANCE OF STORES
DESCRIPTION
UNIT OF MEASURE
ORDER IN QUANTITIES OF
WHEN AVAILABLE SHOWS
LOCATION IN STORES
SYMBOL
PART NO.
INSTRUCTIONS FOR POSTING:
NOTE—IN ALL CASES BRING DOWN AT ONCE BALANCE IN EACH COLUMN AFFECTED
1—ORDERED BUT NOT YET DELIVERED
2—ON HAND IN THE STOREROOM
3—APPORTIONED
4—AVAILABLE
DATE ORDERED
PURCHASE ORDER NUMBER
QUANTITY
DATE RECEIVED
QUANTITY
DATE ISSUED
ISSUED TO ORDER NUMBER
TOTAL COST
COST PER UNIT
DATE APP. OR ISSUED
QUANTITY
APPORTIONED TO ORDER NUMBER
DATE DUE IN STORES
DATE
QUANTITY
REMARKS
Material
Dwg.
Size
From
Purchase Order
DEFECTIVE MATERIAL
Date Rejected
Amt. in this Lot
On Purchase Order
Reason for Rejection
Disposition
DATE RECEIVED
MONTH
DAY
STORES SYMBOL
LOT NO
S
DESCRIPTION
LOCATION
DRAW NO
ORDER NO
KIND OF UNIT
QUANTITY RECEIVED
QUANTITY ISSUED AND BALANCE ON HAND
DATE ISSUED
CHARGE TO
CONTINUED ON BACK
Month
Day
Year
Notification Slip for Productive Material
TRAFFIC PAGE
ON PURCHASE ORDER NO. P
I HAVE RECEIVED
BOXES
CRATES
BARRELS
PACKAGES, CONTAINING THE FOLLOWING ITEMS, WHICH WEIGH
POUNDS. I HAVE TIED INSPECTION TAGS ON SAME. THESE ITEMS (DO) (DO NOT) CLOSE THE ORDER
SIGNED
Storekeeper or His Representative
I HAVE INSPECTED THE ABOVE MATERIAL. THE ACCEPTED QUANTITY HAS BEEN TAGGED WITH A STORES TAG, WHICH HAS BEEN SIGNED BY ME.
REASON FOR REJECTION
REJECTED
ACCEPTED
Month
Day
Year
SIGNED
Inspector
I HAVE ENTERED THE ACCEPTED QUANTITY ON BALANCE SHEET, INCLUDING THE PRICE
AS TAKEN FROM THE PURCHASE ORDER
PLUS THE FREIGHT EXPRESS CHARGE OF
AS TAKEN FROM NOTIFICATION SLIP
MAKING THE TOTAL PRICE OF
Balance of Stores Clerk
Purch. Agent
Auditor
SIGNED
Balance of Stores Clerk
Month
Day
Year
Notification Slip for Productive Material
TRAFFIC PAGE
ON PURCHASE ORDER NO. P
I HAVE RECEIVED
BOXES
CRATES
BARRELS
PACKAGES, CONTAINING THE FOLLOWING ITEMS, WHICH WEIGH
POUNDS. I HAVE TIED INSPECTION TAGS ON SAME. THESE ITEMS (DO) (DO NOT) CLOSE THE ORDER
SIGNED
Storekeeper or His Representative
OF FREIGHT EXPRESS CHARGES ARE TO BE ADDED TO THE PRICE OF THE VARIOUS ITEMS ON THE ABOVE PURCHASE ORDER, AND TO BE DISTRIBUTED AMONG THEM ACCORDING TO THEIR RESPECTIVE PRICES
Traffic Manager
Balance of Stores Clerk
Auditor
SIGNED
Traffic Manager

FIG. 20 FORMS AND ROUTINE FOR ORDERING, RECEIVING, AND STORING MATERIAL

view of storeroom showing cutting-off machines and steel racks.

As a matter of convenience for itself, the material control department has laid out graphically the schedule for the principal events with which it is concerned, in the manner shown in Fig. 23. Horizontal distances from right to left represent working days ahead of completion. For each part there is noted at the proper distance from the right, measured on the scale of working days, the time of each event with which material control is concerned. These are, from left to right, the time of engineering release of design, the time of purchase requisition, the time of arrival of material in rough stores, the time of the first operation, the time of arrival of the finished part in worked material stores, the time that assembly of the finished tractors should begin, and on the zero of the scale the delivery of the completed tractor. The movable strip at the top is equal in length to the length of the manufacturing program, and is graduated on the basis of tractors in the program. Each day this strip is moved from left to right a distance equivalent to the space allotted to one working day. As the zero point of the strip passes any event on the schedule, it indicates that the necessary steps to cause that event to occur are to be taken. Thus when the zero passes the point of purchase requisition for any part on the schedule, that is the time at which the material for that part should be requisitioned from the purchasing department, and the purchase requisition is issued. When the zero of one strip passes the point of "due in stores," the material called for by the purchase requisition should be either in the storeroom, or arriving according to the schedule called for in the purchase order. Similarly, when the first operation is indicated by the zero of the moving strip passing that point, the work orders to the shop are issued. Each event is thus under definite control.

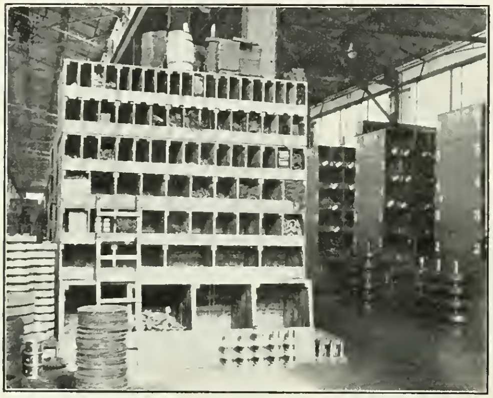


FIG. 21 STOREROOMS SHOWING BINS WITH BIN TAGS ATTACHED

This chart is made to act as a record of progress, by entering at stated periods in the space above each event noted on it, the amount of work done on the part at the end of that period. From these entries, it is easy to determine whether the work is ahead of, behind, or on schedule. For instance, if at a given time there should appear in the space above "due in stores" the figure 40, representing that material for that part sufficient to build 40 tractors had been delivered, and the figure 40 should appear immediately above it on the moving strip, the delivery of material would be exactly on schedule. If, however, the figure on the strip should be, say, 48, then the deliveries are behind schedule. On the other hand, if the figure on the strip is 32, the deliveries are ahead of schedule.

Checking the Observance of Schedule

To ascertain how far behind or ahead of schedule the parts are, recourse is had to another strip, graduated to read in work days, on the same scale as the time scale on the schedule layouts. This reads from zero from right to left, the zero point being set to correspond with the start of delivery of finished tractors. A movable vertical guide at right angles to the moving strip is set over the figure in the moving strip that corresponds to the figure entered above the event that is ahead of or behind schedule. The number of working days on the work-day strip is read under the guide, and the difference between this number and the number on the work-day strip immediately below the event that is being considered, is the number of days that it is off schedule.

The charts have another important function, namely, the fixing of definite dates on which the various events are to take place. When design, methods, and lot quantities have been standardized, the schedule can be laid out on the chart as above outlined. Since events are laid out on the basis of working days intervening between them, the chart shows the relative time at which these events will occur, irrespective of the actual calendar dates on which deliveries are to be made or work started. The schedule then can be applied to any program in which the lot sizes are the same.

The schedule is made absolute in regard to any particular program by the fixing of calendar dates for each

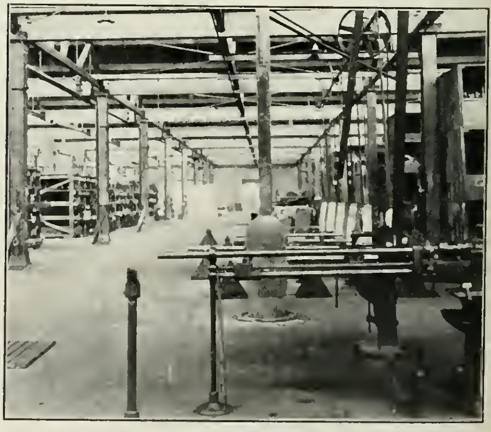


FIG. 22 STOREROOM SHOWING CUTTING OFF MACHINES AND STEEL RACKS

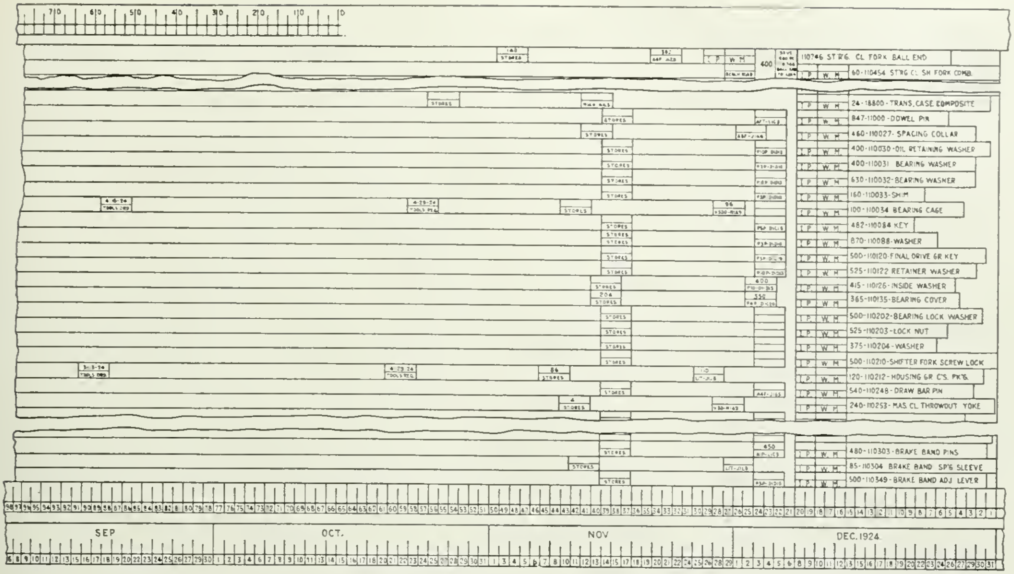


FIG. 23 CHART USED BY MATERIAL CONTROL DEPARTMENT TO SCHEDULE AND KEEP TRACK OF OPERATIONS

event. This is done by means of a third strip, graduated the same as the work-day strip, but reading in calendar dates instead of number of work days. The calendar strip has all Sundays and holidays omitted and reads from left to right. That is, the earliest month and dates are at the left of the strip. The date on which deliveries of tractors, covered by a manufacturing program, are to begin, is set to correspond to the zero of the work-day strip. On setting the movable vertical guide over any event, the date on which that event is to take place may be read directly under the event on the calendar tape. This gives the necessary information at once for dating requisitions, work orders, etc., for the program.

Similar Chart Used at Franklin Plant

The chart described above is based on the same principles as formed the basis of the control boards developed and used by the author at the plant of the H. H. Franklin Manufacturing Company. It was worked out by J. E. Murphy who is in charge of material control at the Holt plant, to give him exact knowledge to control the movement of work through the plant. So successful has it proved that a decision has been made to install control boards similar to those at the Franklin plant. These boards will show in addition to the major events shown on the charts, the detail machine operations, and will make the control still more effective.

It will be evident from what has already been said that accurate preplanning is the whole secret of the Holt Company's success in controlling production. But preplanning is more than the laying down of schedules. These are simply the final evidence of preplanning. Before preplanning can be made effective, much exact information must be acquired. This information covers such points as time required to obtain material, best methods of doing work, the best sequence of operations, and the time required for each operation. It also requires knowledge as to whether a part of the finished tractor can be made more cheaply by another manufacturer or in the plant, and if so, exactly how long a time will be required to procure these parts. Each of the above items must take into account several other items. For instance, the time required to perform an operation depends on the quality of the material, the shape of the cutting tools, and the type of the machine in which the operation is performed. The two latter items are within the control of the shop. The first one is not, except that it can issue rigid specifications covering all material and parts purchased, and then by adequate inspection and tests upon receipt of the material, ascertain whether these specifications have been met. This helps in the keeping of work up to schedule.

Importance of Uniform Quality of Material

All shop times are based on a uniform quality of material for each part. Thus for iron castings, it is known just what cutting speed and feed can be used for each type of casting when made of the grade of iron specified. If the casting is much harder than planned for, the speed or feed or both must be reduced, and a longer time allowed, or the machine capacity assigned must be increased. Either course will increase the cost of the work, and may seriously affect the possibility of meeting the schedule. Material that does not meet the specifications nevertheless may be perfectly satisfactory to the engineering department from the standpoint of strength and wearing qualities. It may, however, possess some other characteristics that would render difficult its use in the shop. Control in the shop thus demands that the shop have some voice in fixing the quality of material furnished it.

This control of quality of purchased material is a function of the inspection department. Every incoming shipment is subjected to tests to determine whether or not it accords with the specifications. If it does not, the exact variation from standard is ascertained, and the question is submitted to the engineering department to determine if the material will be acceptable from the engineering standpoint. If acceptable, the route and equipment department is consulted to ascertain whether or not the difference in quality will affect its work. If both departments accept it, and a satisfactory adjustment can be made with the vendor, the material is sent to stores. Otherwise it is rejected and returned to the vendor. This insistence on material conforming to specifications is an important factor in avoiding delays in work and maintaining control of production.

Can the Suggestion Box Yield Good Results?

EVERY manager must enlist the assistance of every other person in his organization who can throw any light on the problems which arise. Sometimes he must even have certain problems pointed out to him, for many things can go wrong for years without the head executive ever suspecting that anything is amiss.

A small staff organization can be maintained to assist the manager. The members become official discoverers of weak spots in the organization, official patchers after a fashion. But even they cannot see many things that are going on under their noses. There is no one person or one set of persons that sees everything. The manager needs a thousand eyes for every 500 employees. He needs the ingenuity of all his workmen, foremen, and minor and major officials. He must have everyone on his toes if he would discover and stop waste and inefficiency, and find better ways of manufacture.

Does he get such backing? He does not! Why he does not is simple. There is no very great incentive for anyone to give it. There is neither just reward for improving things nor punishment for not improving. To be sure, the manager has production records, but they tell him only how things go compared with last year or last month. They do not tell him how far short of possibility the actual results are.

The Suggestion Box

The most natural step to take is to put up a suggestion box. But who ever saw many really worthwhile suggestions come out of a suggestion box? Once in a great while some man who has never tried it before puts in a suggestion that has merit, but most of what comes out of these boxes is foolish, and sometimes scurrilous.

Such confidence on the part of all employees must be established that they will be sure of fair play and will want to make every possible helpful suggestion. No man with an invention or a suggestion that will profit the company by thousands of dollars, is going to put it into a $10 competition. Why should he? He may put $5 suggestions in, hoping to get the $10 prize, but if he has a good one he will probably hold it for the chance to sell it to someone for its real worth.

For that matter, no reasonable employer wants to get a $10,000 improvement for $10. What he is afraid of is that some employee with a $10 invention is going to value it at $10,000, and if he does not get it, is going to cease to be a contented worker in the organization.

Index Number
658.31472 Suggestions from Employees
608 Inventions

From any point of view—legal, moral, or ethical—ordinary wages and salary call for only ordinary effort. The man who gives more than that does it as a matter of speculation. If he invents a method or process which will save thousands of dollars each year and presents it to the firm for which he works, he is gambling on their sense of fair play. He often loses. Often enough, so that a great many men do not try it twice.

A friend of mine performed a number of experiments from which has grown a great business—a business that easily hands its stockholders a million a year. He got $100 for his part. Does he feel just right about it? He does not. And yet he was the one that set the price. Of course he should have been far-sighted enough to turn this invention over on a royalty basis, a cent a pound, for example, in which case he would be a millionaire today. But he did not see its possibilities. He is not making any more such improvements; not for $100, anyway.

As a general rule, the value of a new machine or device, or a new method of manufacture, cannot be appraised with any accuracy at the time it is made. No one would have paid the true value for the telephone, the phonograph, or the automobile, at the time each was first put before the public. The value of every new thing is likely to be contingent on something yet to be invented. The automobile forced the development of good but inexpensive roads; the original telephone would have no commercial value today. Part of the gain from any invention is likely to come from other inventions suggested by the first.

Disposing of an Invention

So any inventor, no matter how simple his invention, should be careful not to sell it outright if he can get it accepted on a royalty basis, and no firm should buy outright if it can get the rights to a new device on the same basis. When either sells or buys in the early stages of invention, before the device is seasoned on the market or in use, he is gambling. The gamble is usually thought to be favorable to the company, but almost any concern that has been in existence 25 years can show a museum full of devices that it has financed only to discard them in the end at a total loss.

Investigations Preliminary to Refinancing

By W. PENN LUKENS

Assistant Manager, Industrial Engineering Dept., Arthur Andersen & Co.

Index Number
658.14 Financial Analysis
332:658 Banking and Management

Audits of accounts are a matter of ordinary office routine—audits of management have been suggested. In the present article Mr. Lukens describes an audit broader and more comprehensive than either of these—the investigation made by the investment broker preliminary to the sale of a company's securities—if the company can qualify. In order to determine this point the company's history and organization, and every important phase of operating activity, are gone into with careful thoroughness. A better "check-up" of company status and efficiency could hardly be desired.

INDUSTRIAL conditions in this country within the past few years have directed public attention to the important functions of the investment banker. They have also led to a somewhat different interpretation of these functions.

It has always been recognized that the investment banker is a medium for providing capital for sound, well established, prosperous, and correctly managed business. Now he is also universally recognized as the means whereby the small investor may safely realize an adequate interest return on his savings, and it is a question as to which function is predominant.

From either viewpoint it is essential that the investment banker who is to remain in business must do more than merely redistribute capital—he must assume a moral responsibility for the use of this capital and for the return of adequate interest. It is in line with this responsibility and to insure a full knowledge of conditions surrounding the business financed that the banker makes use of various classes of independent investigators. As one banking house aptly states: "By means of experience, study, and a broad fundamental knowledge, and by exercise of sources of original investigation, an investment house may avail itself of information useful in the safeguarding of its clients, which is its primary and greatest responsibility."

The day is practically past when an investment banker considers that sufficient knowledge of a business may be gained from the balance sheet, the profit-and-loss statement, and the conference statements of the company officials alone. He has found it necessary even on small issues amounting to only $100,000 or $150,000, to have the financial statements certified by public accountants, to have the property values verified by appraisers, and to have attorneys pass on the legal aspects of the issues—and the patents of the company, where they are important—but he accepts without proper verification the general statements of the management. And it is these general statements which furnish the only real basis for judging the future of the company.

During the past few years some bankers have come to realize the importance of verifying this broader and more general information, and to meet the requirements of this small group the industrial engineering investigation has been developed.

Comparatively speaking, very little is known about this work partly because of its newness and partly because of the different methods employed by various engineers and engineering organizations. The most conservative and effective results have been shown by engineers associated with, or a part of, public accounting organizations, who have had the benefit of the experience of long association with investment bankers and their problems. It is the purpose of this article to outline briefly the purpose, the scope, the methods employed, and the nature and value of the results secured by a properly directed industrial engineering investigation of business concerns.

Purpose of Investigation

From the viewpoint of the investment banker the appraisal shows the *tangible* values underlying the proposed issue of securities, which must be high enough so that, in the event of forced liquidation, the bondholders' equity will be protected. The audit figures reflect the *tangible* values back of the issue, show the make-up of these values, indicate the necessity for, and the amount of, the proposed issue, and provide a history of past operations and earnings. Neither the appraisal nor the audit, however, consider and weigh the individual effectiveness of those elements—such as good-will, patents, processes, quality of product, organization, equipment, and the policies of control—which combine to produce earnings. These factors are intangible and mutable over a 10-, 15-, or 20-year period of time, and for the proper protection it is necessary to analyze the effectiveness and to measure the results secured by each such intangible element.

Consider the banker's responsibility in attempting to forecast on the basis of present values and of earnings for a comparatively short preceding period, the future stability and earning power of the business. The strong personnel now in control may, in 10 years, disappear entirely, due to death, sickness, age, or shift of interests. Patents which are now resulting in large and almost monopolistic earnings may, within a few years, expire and let in strong competition. A product which is now a necessity of life or at the peak of a popularity wave may shortly become unsalable, being displaced by some other product, or falling from public favor. The improvement of transportation may result in a lessened market through bringing in competitive products at lessened prices. Manufacturing equipment which now permits operating at a profit may presently have to be replaced by more modern types or result in loss of business on a price basis. To secure such vital facts relative to a business, to analyze them in relation to each other, and to interpret them in the light of results already disclosed by audit figures, is the purpose of the industrial engineering survey. It is obvious that such work requires a type and quality of effort and methods which are not found in the ordinary audit prepared by accountants.

Scope of Industrial Investigation

Since the engineering findings are so largely an explanation of financial figures, the engineering and accounting efforts must be closely co-ordinated and carefully controlled.

Indeed the best and quickest results are secured by an organization which employs engineers and accountants who have had long experience in working together on investigations. Such an association not only insures complete covering of all vital points, but permits the placing of emphasis or volume of work at proper points. For example, the financial records of a company may be such that an audit is not necessary or may not be worth while until the so-called industrial status has been determined. Emphasis must therefore be placed on the engineering analysis supplemented by interpretation of the financial figures by an accountant. Unless the investigating organization has both engineers and accountants it may be necessary either to have a complete audit and a complete engineering survey or to run the chance of improper or incomplete analysis on the part of the engineers or accountants operating alone.

This thought is given added weight when considering the points which must be covered by an investigation. Experience in working with various investment bankers has proved that, while no two investigations will be exactly alike, analyses must be made covering the following fundamental points:

1. Inception and capitalization.
2. Products and market.
3. Properties and operating conditions.
4. Personnel and control.
5. Organization plan.
6. Merchandising policies.
7. Record systems.
8. Sales.
9. Growth of net worth.
10. Earnings.
11. Return on investment.
12. Surplus.
13. Present and proposed financial position.
14. Financial statistics.

From a study of these "14 points" it is obvious that there exists a very necessary correlation of data and viewpoints of engineers and accountants. Any one or a number of these points may demand special emphasis, but the emphasis is not apparent, nor can it be forcefully presented, unless all the points have been covered and given a definite importance in the picture as a whole.

The report for refinancing purposes will vary in form in accordance with the nature and conditions of the business, but the average outline should be:

Summary
  Inception and net worth
  Plants and products
  Personnel and organization
  Marketing and distribution
  Sales
  Earnings

Financial Position
  Present status
  Status after financing

Operations for Five-Year Period
  Sales
  Gross profits
  Selling and delivery expenses
  General and administrative expense
  Net profits

Financial Condition and Disposition of Funds
Detailed Analyses
  Plants and products
  Production and capacities
  Personnel and organization
  Marketing and distribution
  Distributing efficiency
  Sales and prices

Primarily the differences between reports may be traced to the various characteristics of the individual businesses. Thus in one case the vitally important point may be the status of the industry as a whole. An example of this is seen in the automobile industry, in which the perennial question is whether the "saturation" point has been reached. Then there are cases in which conditions in one industry depend upon conditions in another. Analysis of the automobile industry is an essential supplement to any analysis of the tire industry. Likewise the saw-milling, brick-making, lime, and concrete industries will fluctuate with conditions in the general building industry, and the farm implement industries will be greatly influenced by general agricultural conditions.

On the other hand, industrial conditions may be very stable and the vital points may be purely internal, involving the quality of management, policies of sales distribution, financial policies or type of product. Almost always a company has some outstanding strength or weakness which will absorb much of the investigation time and will dominate the final report. The result is that each report is different in form, draws different conclusions, and gives the impression that the entire investigation has been different in character. Another difference is that some reports are "positive," practically approving the issue and suggesting only a few safeguards advisable to incorporate in the contract, while others will be "negative," either advising against the issue entirely or else stating changes in company policy and structure, which if put into effect may warrant the issue at some later date.

Both the form of the report and the determination of the points to be considered and emphasized will depend largely upon the interpretation of facts. The facts themselves will be secured from two main sources. History, policies, results, etc., of the particular company are secured from the company records and verbally from the company personnel. Information on the industry in general, markets and so forth, is secured from publications and personal research. Personal research, moreover, is also necessary in determining the effect of sales policies, the quality of the product and so forth. It is, of course, very essential that all information secured be accurate—that actual facts be obtained. This factor is protected, so far as the accounting records of the company are concerned, by the audit.

Thus profits between years may only be correctly stated when the Surplus account has been analyzed and reconciled with the operating statements. The profit-and-loss analysis is also dependent for correctness upon the proper handling of the various reserves (depreciation, bad debts, taxes, etc.). The statement of the assets accounts is influenced by the company's policies with regard to the capitalization of experimental expenditures and development charges, or by the correctness of distribution of charges as between operating and construction.

Certain other classes of data from the company records are more statistical in nature, especially those involving sales. Yet here also verification is necessary. Thus the company record of sales by products or by territories may often fail to agree with the sales control accounts or with the records of sales to customers. If the purchasing agent's record of purchase commitments is used it must be correlated with accounts payable. If the sales manager's record of unfilled orders is used it should be test-checked against shipping instructions, against customers orders, and possibly against production orders or schedules. If the book record of inventories is used the accuracy of this record should be verified by tracing entries and by physical test checks.

While the information contained in government publications, publications or special data from "service corporations," and material provided by manufacturers associations and by trade publications is considered to be accurate, it should be carefully tested as far as possible, especially where two different sources provide information on the same subject. Verbal information of course must be checked, as far as is practical, by records and by the opinion of others.

Where the Investigation Leads

The gathering of facts is of considerable service in itself and an investigation always brings to light certain conditions unknown even to the management. But the interpretation of these facts, the reason why certain conditions exist, and the proper sequence and analysis of conclusions is the most important and constructive part of the work. Thus the discovery that quantities of obsolete stock are carried in the inventory is an important fact, but it is even more important to know why the obsolete stock is there and how it can be avoided in the future. One concern through lack of proper records actually lost track of a considerable quantity of parts. When their existence was discovered by investigation it was found that the design of product had been so changed that these parts could no longer be used. It was the policy of another company to get out new and attractive models in rapid succession without regard to the stock of older models on hand or in process, with the result that products were sometimes actually obsolete before they were finished. In both cases the investment bankers were more interested in the cause for such conditions than in the effect as represented by obsolete stock, even though the effect on the inventory values was serious.

There is also the other side, where the facts disclosed may at first glance appear discreditable. Thus one company found it necessary to redesign its entire product, which automatically caused the older designs to become obsolete and be scrapped or sold at a loss. This policy at first appeared radical and even reckless but it was found that popular demand had changed very suddenly and such action was necessary to the continued success of the business. In this instance the company had not fully informed the investment bankers as to the reasons for this action and they were inclined to turn down the issue on the basis of the large quantities of obsolete stock disclosed.

What the Industrial Engineering Investigation Does

It is obvious that an industrial survey must be made from a very constructive viewpoint and must not only indicate and interpret strength and weaknesses, but must also recommend the means of overcoming existent weaknesses. A company which is in a commercially dangerous position may rehabilitate itself by correcting the factors which have induced this condition. In view of this fact and the scope of the subjects covered by an industrial engineering investigation, the engineer must often lay aside the technical characteristics of his profession and must always view the business from a broad and practical standpoint.

Moreover, the industrial engineer, being in constant touch with all kinds of businesses and in daily consultation with clients on various phases of these businesses, is able to recognize symptoms of business illness and to diagnose properly the source of the trouble. Similarly the present-day accountant is using his particular experience and knowledge on financial matters. It is only recently that this function has been brought to the attention of, and used by, investment bankers. The protection afforded, however, is such that it is not unreasonable to predict that most circulars will soon follow the form of one recently published, which stated "Audit and *Industrial Engineering Survey* made by .... & Company".

The industrial engineering findings are always important, but they become especially so when the audit figures are "border line"—that is, when average earnings do not provide a reasonable margin of safety after meeting interest, dividend, and sinking fund requirements, or when the fixed asset values fail to show a fair safety factor on principal.

It is impossible in a limited space to give a complete idea of the scope covered or the factors commented upon in one of these engineering analyses. The outline previously given serves merely to indicate the general high spots. In some cases it is possible to summarize for the banker the more vital conclusions, while in other cases facts are presented in such a manner and sequence that the conclusions are self-evident. Yet in almost every business investigated there will be one or more vital points of comment, possibly relative to organization and possibly relative to sales, markets, or financial policy. A few examples of general conclusions and actual comment on specific cases will give the clearest conception of the scope and value of engineering analysis, as well as the nature of the comments made.

One case is recalled in which past earnings were shown to be far in excess of the proposed interest requirements while assets were such as to indicate a fair measure of protection, yet the issue was rejected by a certain investment banker on the basis of the industrial analysis. This analysis brought out the fact that the company made only a very durable cotton hosiery on which they had specialized for many years. The management contemplated making no other type of stocking and laughed at the idea that a lighter weight or silk-material product could ever displace the demand for their more durable hosiery. Yet at this time (8 or 10 years ago) it was evident from facts brought out by the investigation that the trend of public fancy was turning rapidly to the silk stocking.

In another instance a large bond issue was underwritten by the bankers on the basis of a trust indenture formulated as a result of the survey conclusions, these conclusions being expressed as follows:

> The organization and personnel of this company are of a highly satisfactory type and its operating and merchandising policies are sound. Yet it appears that conditions for any company in this general industry will be uncertain during the next few years and very large losses may be incurred.
>
> The real justification for this issue lies in the present stock ownership. If these stockholders who are financially able to carry the company through a period of losses and no dividends, will agree to retain their interests during the life of the bond issue, a measure of protection will be attained which is far greater than that indicated merely by a review of the present assets and the records of past earnings.

Effect of Combining Accounting and Engineering Points of View

The following summarization of points on a certain investigation shows the influence and importance of some of the more general features, and illustrates the effect of combining the accounting and engineering points of view to give a result which normally would not be attained by either the accountant or the engineer alone:

1. The company's earnings in the past in relation to capital employed have apparently been very low. Whether or not this is characteristic of the industry as a whole we are not in a position to state without further investigation. At no time, however, during the past twenty years have losses (other than inventory losses) been sustained from operations.
2. The company's dividend policy has not been conservative, nor has it been the policy to conserve its resources. Indeed, even under the present financial strain the policy has been to continue dividends on both common and preferred stock. This calls for an annual distribution of $470,000 which we feel is unwarranted under the present conditions.
3. In view of the fact that an operating deficit of upward of $2,000,000 exists at this time, rather stringent restrictions with respect to dividends should, in our opinion, be incorporated in the new indenture if the refinancing is undertaken.
4. The company is apparently well situated with respect to modern production facilities, is engaged in a fundamental industry, and enjoys a good reputation for the quality of its product. Yet the management has not been overly aggressive in the sales end of the business and if it hopes to earn profits commensurate with the capital employed it will be necessary to strengthen this part of the organization.

Determination of Outstanding Factors

Usually certain points within the business under investigation are outstanding in their effect on earnings. Sometimes it will be a point in organization, sometimes in sales or manufacturing. The following example of an organization's weakness is worth quoting as illustrating its importance to the future conduct of the business:

> The organization plan is for present conditions fairly well defined and the personnel is, in general, capable. The basis of control has, however, been that of personal contact and conference rather than of definite authorities and responsibilities. There has been no general manager with full authority to co-ordinate and broadly direct the different sections of the work, while the preponderance of development over actual operating has created special problems outside of the usual operation routines. It is this lack of single authority and responsibility which is in part responsible for the weak financial policies and present unsatisfactory financial position, as discussed elsewhere in more detail.
>
> Under the proposed program of expansion the matter of definite control will become more vital and the probable best solution involves the following points:
>
> 1. Immediate creation of a strong executive committee which shall be kept closely informed on the details of the business, but composed of men who can direct its commercial aspects and who are empowered to make broad decisions as regards the sales, financial, and operating policies.
> 2. Eventual delegation of these responsibilities to a general manager of such caliber as to relieve the executive committee from the necessity of detailed control.
> 3. Appointment of a competent comptroller with the additional qualifications necessary to revision and supervision of the cost, inventory, and accounting records and procedures.
>
> We believe that the reshaping of this main organization control is one of the most important steps to be taken from the viewpoint of assuring sound growth and permanence of the company, and should be worked out as rapidly as possible.

To show the influence of sales methods and policies upon the probable soundness of proposed securities, the rather unusual case may be noted of a company which had for several years been supplying about half of its output to another company under an indefinite "cost-plus" contract. Industrial depression and lessened sales had led to a proposal for a bond issue. The comment on this follows:

> As has been previously indicated, the increase in sales and hence the growth of the company since 1915 has been due only to the "contract" sales. There are two possible explanations for this condition: first, that due to trade agreements and transportation differentials there is a definitely limited market for the "regular" products; or second, that the terms of the cost-plus contract have been so favorable that no real effort has been made to extend the "regular" sales. Our judgment is that the latter factor was the real influence.
>
> Furthermore, very large increases in sales, clerical, and administrative salaries have been made in this period, part of the increase being absorbed by "contract" sales (which required no sales effort and very little additional clerical work) but part being applied to the cost of "regular" sales, on which the increased selling price prevented an increase in unit sales.
>
> In addition to the limiting effect imposed by the increased prices there has also been an apparently indifferent sales and service attitude, illustrated by the fact that of the 129 principal customers in 1916 only 37 repeated in 1917, only 27 in 1918 and only 19 are on the books this year. Our analysis indicates also that two out of the three principal lines of "regular" products have fallen off considerably in unit sales. These declines in unit sales have been obscured in the company sales analyses by increase in unit prices, since all such analyses dealt with sales values only.
>
> The proposed cancellation of the cost-plus contract at this time places the company in a precarious position, since increases in salaries, in manufacturing areas, and in inventories cannot be supported by the income from "regular" sales, and the company has so prejudiced its normal trade position during the past few years that increase in regular sales is problematical.

The possession of such a report in a way enlarges the moral responsibility of the banker. For it is often the case that the company officials refuse to admit the importance of the engineering findings and are content to go along in the same old way, despite the fact that these old ways were successful only in a smaller organization or under different conditions of the industry or of business in general. The broader experience of the banker, however, qualifies him to recognize the truths of the engineering analysis, and it should be his duty to put pressure on the management to bring about the suggested revisions. His responsibility is to make the business prosper, in the interests of industry, and to justify future financing.

The attitude of the bankers and manufacturers who do not make constructive use of such engineering investigations cannot be charged entirely to mental antagonism. There are many bankers and more manufacturers who do not know that such an analysis is possible. They are used to thinking of the industrial engineer in connection with time-study work, detailed production systems installation, bonus plans or material controls. They are not familiar with the engineering and accountant organization which has the broad commercial viewpoint and the capacity to deal intelligently with all phases of the business, from economic trends and sales budgets down to petty cash systems and stockroom records. The best and most immediate service the industrial engineer can perform for industry in general is to make known the full scope of his work and to educate bankers and business men to utilize the service he offers.

Waste from Cannery Products Furnishes Oil and Fuel

Index Number
658.5671 Utilization of waste

ALONG about 1913, when heaps of peach and apricot pits were getting to be a common sight as well as a generally accepted nuisance in the California fruit canning establishments, a number of leading canners of the Santa Clara valley formed a company for the purpose of manufacturing kernel oil. Prior to this period, all the kernels available in California—some 1500 tons annually—were used in Europe, mostly in Germany, to make not only the sweet oil of apricot kernels, but the essential oil of almonds as well, and also macaroon or imitation macaroon paste from the residue. The newly-formed California company was doomed to failure and a loss of $100,000, as all they were able to manufacture was the sweet oil of almonds.

Later on, in 1915, the three commodities were successfully manufactured by a small California organization which had taken up the experimental work where the original company composed of canners had left off. Today through the efforts of Stanley Hiller, a waste products engineer, who worked out the different steps in the manufacture of kernel products, most of the apricot kernel commodities are being manufactured in the United States.

During 1915, there was no European demand for apricot kernels, and therefore the price was very low. Hiller had been manufacturing the oil and paste on a small scale for nearly a year. He saw his opportunity and accordingly negotiated for the purchase of five carloads of kernels from one of the large canning establishments. In January 1916, 30 days later, a fire occurred in

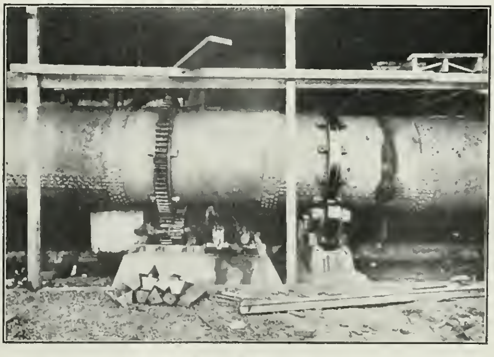


FIG. 1 ROTARY KILN TO MAKE CHARCOAL FROM PITS

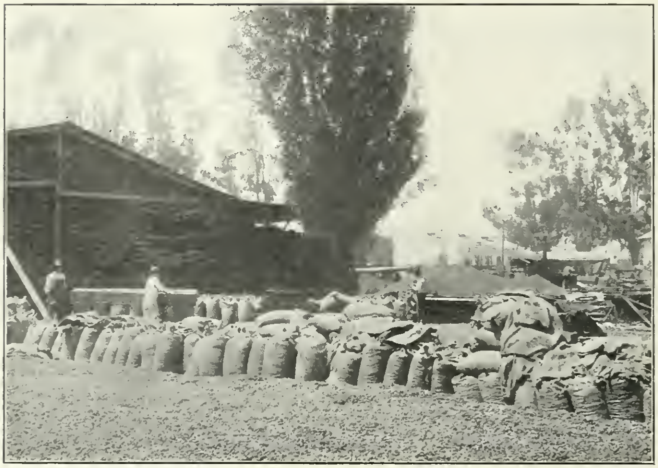


FIG. 2 PEACH AND APRICOT PITS ARE RECEIVED IN BAG AND BULK

San Jose, where great quantities of apricot pits were stored. Then, in one day the price of apricot kernels advanced from 6½ cents per lb., the figure at which he had expected to buy, to 25 cents per lb.

This rise was due to the fact that the Germans wanted edible oil at any price, and were buying kernels through Holland and Denmark. The two or three thousand tons of apricot kernels remaining on the market were taken within a week, and the new American venture was temporarily put out of business. The following year the Hiller process was sold on a royalty basis, the royalties running as high as $1600 per month. The products are still being manufactured under this process.

While the above developments were taking place, the Germans began launching their gas attacks. It was found that apricot and peach pits, or cocoanut shells, could be made into charcoal for gas mask purposes to combat the poisonous gas. But the visible supply of such material was low. Hiller informed the Chemical Warfare Service Headquarters that thousands of tons of coquito shells could be obtained on the west coast of Mexico. As a result he received a contract to collect 5000 tons of these shells each month.

Of course, following the armistice, this and similar contracts were canceled as soon as possible. However, the United States government had at its San Francisco charring plant a pile of pits and nut shells that covered an entire city block, from 10 to 15 ft. deep. Hiller had worked out and patented a process for the cracking of peach pits, and as these formed the bulk of the government material then at San Francisco he bought the entire supply. His plan was to crack them, and remove and sell kernels to the company which was already using his process for the manufacture of apricot and peach kernel products.

There were $60,000 worth of kernels in the lot. By the time a cracking plant was built and ready for operation the winter rains set in and completely spoiled the kernels for oil purposes. The people who owned the property had been guaranteed the removal of these shells. Notice was now received to complete this removal within 30 days.

The situation did not look promising. The pits could be used only to make charcoal for fuel. Upwards of $1,000,000 had been spent by the government to perfect the charcoal manufacturing process, and the average cost per pound of charcoal produced had been 37 cents. The lowest possible estimate on future operations was a cost of 10 cents per lb. of product, but charcoal was selling for 3 cents per lb.

A new method for the manufacture of charcoal was finally worked out. The pits were loaded into cars and shipped to a leased plant where work was started on converting them into the finished product. Fig. 1 shows the revolving drum or kiln used in the reduction process. Fig. 2 shows the material as it is received.

Whereas the plan used under government operation required 200 men for the making of a carload of charcoal daily, now 5 men turn out the same quantity in the same time. Needless to say the venture has been profitable, and a large factory located at San Jose converts into charcoal 10,000 tons of shells per year.

Conversion of pits into charcoal is also done directly at canneries. One of the largest in California, using this new method, makes enough fuel from the pits collected in its canning processes to develop over 1000 boiler hp., which runs the entire plant. See Fig. 3.

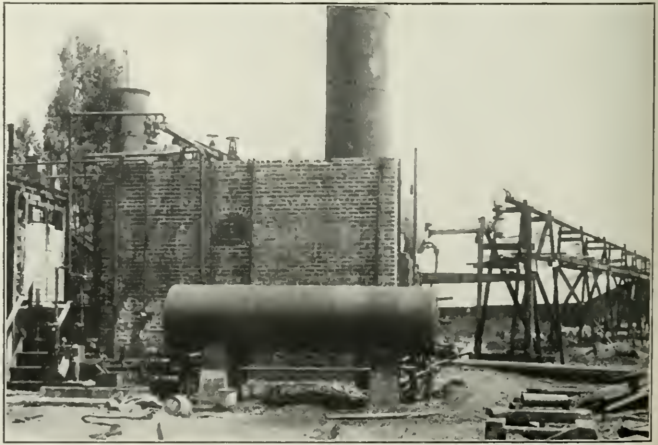


FIG. 3 STEAM FOR AN ENTIRE CANNERY IS MADE BY USING PITS FOR FUEL

Elements of a Financial Investigation

By RALPH G. DAVIS

Certified Public Accountant

THE financial investigations made in the past, prior to the financing of large corporations, upon which the public investor largely depended to base his judgment in the purchase of mortgages, notes, or shares, were very limited in scope and failed to procure certain essential facts that we now consider of vital importance properly to safeguard the interests of prospective investors. A detailed audit by a firm of reputable accountants, and a valuation of physical properties by a firm of recognized appraisal engineers, were usually considered sufficient to satisfy the bankers responsible for the disposal of a corporation's securities or stock interest.

Such an investigation is no longer adequate. The constant progress in business development, the interest displayed by the general public in corporation investments during recent years, the new problems caused by our tax legislation and changes in manufacturing methods, all combine to demand a more detailed study of every phase of each particular organization, and the possible effect of the new conditions upon the future trend of its operations.

The accountant must still share his burden with the appraisal engineer in this particular undertaking, but the scope of the former's duties has been greatly enlarged and the introduction of a skilled industrial engineer familiar with the problems of the particular business is gradually being recognized as an essential feature of such an investigation.

In the following outline, or program, of a modern financial investigation, an attempt has been made to segregate clearly the accountant's and engineer's duties. No doubt, it will be subject to considerable adverse comment among members of the two professions due to vast differences of opinion in regard to the respective duties of each, but the indicated assignment seems to the writer the most logical division of responsibilities.

Accounting Requirements

1. A detailed audit of the earnings of the business over a period of years as far back as may be consistent and necessary. An audit of balance sheet items as of the date of the balance sheet. Both earnings and balance sheet items should be analyzed in such detail as to conform to the requirements of the exhibits and schedules submitted to the various state "Blue Sky" commissions. The adequacy of the accounting system should be ascertained and constructive criticisms made relating thereto.

2. A study of the management and organization of the general offices and sales branches, charting the present organization structure and comparing it with the ideal form, indicating the advantages attained thereby. This should also be accompanied by a study of the office personnel, ascertaining the weaknesses and strong points of each major and minor executive and offering constructive criticism for definite improvement.

658.14 Financial control
657.4 Financial investigations. Accounting

The information required in the investigation of personnel is as follows:

(*a*) Name.
(*b*) Position.
(*c*) Duties.
(*d*) Age.
(*e*) Salary.
(*f*) Bonus or profit-sharing arrangement.
(*g*) Percentage of stock ownership.
(*h*) Length of service with the company.
(*i*) Is he a relative or descendant of organizers of business?
(*j*) Previous working experience.
(*k*) Personality.
(*l*) Reputation.
(*m*) Any special interests or hobbies.

It should be particularly noted whether the managing executives have a large or controlling pecuniary interest in the business.

From the standpoint of organization the following questions should be answered:

Is there a definite plan of organization?
Has the management definitely outlined to each department or division its necessary duties and responsibilities?
Is there a proper correlation between departments?
Has a vocational study been made of each man to ascertain his fitness for the position occupied?

3. Is the necessity for financing caused by past inefficiency of management, or is it a justifiable provision for future expansion or preservation? Or is the business which is to be expanded and developed a new one rather classified as a speculative development and not an investment? The need for financing or refinancing usually arises on account of one or more of the following conditions: (1) the refunding of bank loans; (2) the procurement of additional working capital; (3) the acquisition of new plant and equipment or controlling interests in other companies or units; (4) the sale of a large stockholder's interest either upon his retirement or to interest the public in a business previously operated as a close corporation; (5) the sale of large holdings for other purposes as the diversification of holdings; (6) a pending reorganization; (7) frozen inventories, or (8) the refunding of prior issues.

4. Operating history—Date of organization—Growth in capitalization—Has the growth of net capital invested during the period of existence been largely out of earnings?

5. A study of the administrative policy relating to the following phases of any business is vital.

1. *Sales and service*
    - (*a*) Stability of prices.
    - (*b*) Perfection in line or style of goods carried.
    - (*c*) Standard of quality.
    - (*d*) Distribution centers and sales by localities.
    - (*e*) Arrangements with dealers.
    - (*f*) Quality of service rendered.
    - (*g*) Facilitation of deliveries, repairs, and adjustments.

2 *Credits and collections*
    - (*a*) Basis adopted; "cash and carry," long or short term or instalment. Comparison made with basis of credit usually extended in this class of business.
    - (*b*) Credit policy in dealings with customers.
    - (*c*) Relationship between credit and other departments.
    - (*d*) Records kept.

3. *Advertising*
    - (*a*) General plan—Special or continuous.
    - (*b*) Local or national.
    - (*c*) Choice of mediums.
    - (*d*) Limitation or control of expenditures by budget, percentage of sales, or otherwise.

4. *Purchasing*
    - (*a*) As to basis—whether of the speculative type or largely dependent upon maximum and minimum requirements to insure proper turnover of merchandise.
    - (*b*) Organization of price records and orders and centralized control over the investment in inventories.
    - (*c*) Policies of payment which insure benefit of all discounts and allowances.
    - (*d*) Steps taken to secure scheduled delivery, eliminating necessity of plant shut-downs due to lack of materials.
    - (*e*) Co-operation of purchasing executive with executives of other departments.

6. *Working capital requirements.* Under this heading attention should be given the following vital points:

1. *Inventory analysis*
    - (*a*) Peak and low periods during year.
    - (*b*) Bearing of the conditions existing at both periods upon accounts and notes payable and working capital rates.
    - (*c*) Relationship of existing unfilled orders to present inventory.
    - (*d*) Result of purchase commitments upon future inventory and working capital.
    - (*e*) Relationship of uncompleted production schedule to inventories.

2. Estimated requirements to finance the business.
    - (*a*) Application of working capital ratios ascertained from a study of past net working capital as related to inventory turnover and volume of sales, after eliminating exceptional factors, to compute current working capital requirements.
    - (*b*) Also considering required additional fixed investment if necessary to sustain increased volume.

Industrial Requirements

1. Appraisal of buildings, machinery and equipment and valuation of inventories by responsible engineers, technically acquainted with the operating requirements.

2. In examining the facilities for the manufacture of the company's product, it is necessary to find out whether the company: Is equipped to meet competition: owns or leases its property; can convert its property to other uses; is protected against labor trouble; compares favorably with competitors in investment ratio of equipment to total capital.

3. The management and organization of the factory and its branches should be studied, the present organization structure being charted and compared with the ideal form. This also includes a study of the personnel, to determine the weaknesses and strong points of each superintendent and foreman.

The information required in the investigation of factory personnel is the same as required for office personnel under "Accounting Requirements."

4. A study should be made of the elements which either tend to benefit or handicap the business—such as markets, location, transportation, demand, competition, local labor conditions, and the general prosperity or depression now existing in this particular industry, together with any other of the important factors affecting general business. A study and report should be made of the following factors which may materially affect future possibilities:

- (*a*) Variation in sources of material supply.
- (*b*) Expiration of valuable patents and copyrights.
- (*c*) Stability of public favor.
- (*d*) Possible changes in local labor conditions.
- (*e*) Possible changes in transportation facilities.
- (*f*) Possibilities of new inventions in similar lines changing many external conditions.
- (*g*) General classification of the company's product as a luxury, specialty, or necessity, and the possibility of a change in the general classification in the near future due to varying styles or natural changes. Is the manufacture of the product largely dependent upon activity in any special industry? Does transportation cost limit distribution? Is the product universally used or markets limited? Is the product of a monopolistic or highly competitive nature?
- (*h*) Ability of the management to adjust business to changing conditions.
- (*i*) Possibilities of future control of distribution monopolies, if they now exist.

Measuring the Efficiency of Shop Trucks

Methods Used at the Westinghouse Plant

By STEWART M. LOWRY

Works Manager's Department, Westinghouse Electric and Manufacturing Company

Few people will question the superiority of the electric industrial auto-truck over the hand-truck, for general shop transportation. A saving can generally be shown if the auto-truck replaces even as few as three hand-truckers. To most modern plant executives, such obvious economies are clinching arguments in favor of the auto-truck.

It seldom requires a detailed technical analysis to determine whether or not it would be profitable to replace hand-trucking by auto-trucking. If an auto-truck is suitable for the work under consideration, an approximate figure representing its operating cost should be determined. If the wages paid to hand-truckers more than offset this operating cost, the purchase of an auto-truck would probably prove to be a profitable investment.

However, it would be obviously ridiculous to be satisfied with the savings resulting from the replacement of. say, *three* men if the truck were capable of greater savings by doing the work of *more* than three men.

In the plant of the Westinghouse Electric and Manufacturing Company at East Pittsburgh, Pennsylvania, it became apparent that it would be advantageous to be able to measure the performance of auto trucks in as accurate a way as possible. Hence, a method has been developed for the purpose. By means of detailed study and analysis of their activities, data are secured from which may be calculated the comparative operating efficiencies of the various trucks.

The term "efficiency" is here used to mean the ratio between actual performance, as determined by observation and analysis, and the ultimate possible theoretical performance. It will be readily seen, then, that a full 100 per cent efficiency is impossible from a practical viewpoint, it being only an ideal to approach.

A simple analysis reveals the following as the fundamental factors that make for trucking efficiency.

1. Maximum loads.
2. Maximum running time.
3. Minimum of empty trips.
4. Minimum damage to material.
5. Minimum of men.
6. Minimum of delays.
7. Minimum handling time.

Maximum Loads. The carrying capacity of the ordinary auto-truck is about 4000 lb. Bulk, however, is very often the limiting factor rather than weight. Therefore, the degree of load is based upon bulk. It is obviously inefficient to use an auto-truck to deliver a small package that one man could carry. Yet this is frequently done. If the truck would hold 20 such packages, then its operating efficiency when carrying but one may be expressed at 5 per cent. since it is carrying only 1/20 or 5 per cent of its capacity. Incidentally, a "Shop Express" service, designed particularly to handle these small shipments, is in process of development at Westinghouse, and will soon be in operation.

Index Number
658.281 Industrial trucks

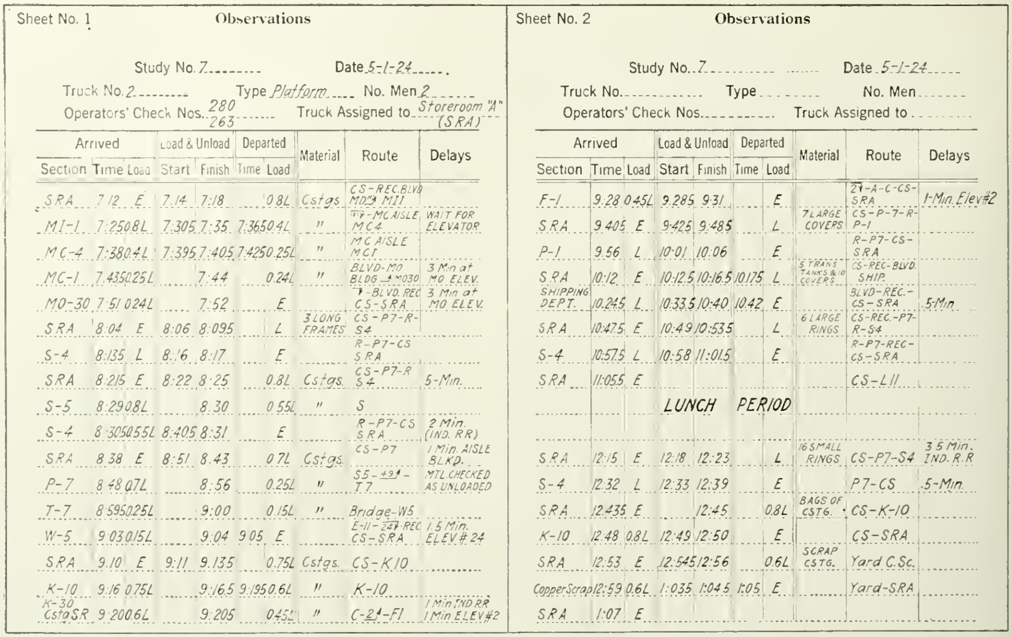
Maximum Running Time. Needless to say, the primary function of a truck is to transport material from one point to another, and its effectiveness is judged by the volume it handles. It is reasonable to assume, then, that the volume of material handled will be greater, as the running time is greater with respect to the total time. It follows that auto-trucks are more productive on the longer hauls which necessitate the trucks being in motion a comparatively greater portion of the time, rather than on short hauls involving idle time during loading and unloading.

Loss by Empty Trips

Minimum of Empty Trips. To secure the maximum of service, a truck should be so dispatched, when sent out with a load of material, that it can pick up a return load at or near the delivery point of the first trip. The two extremes in this connection are to have all trips loaded in only one direction, and to have all trips loaded in both directions. The latter condition is, of course, ideal where a full load is carried on each trip. But this is seldom possible. Even perfect dispatching will not suffice without paying attention to other factors.

Minimum Damage to Material. A considerable amount of good work in dispatching, arranging for maximum loads, etc., may be quickly offset by damage to material being carried. This may be due to improper packing or piling on the truck, recklessness of the truck operator, overloading, etc. For this reason the transportation of fragile material or apparatus is frequently not entrusted to auto-trucks but is done by hand-trucks.

Minimum of Men. The auto-truck is essentially a labor-saving and time-saving device. Hence, its very purpose is being defeated if more men are placed on it than are absolutely necessary. While the truck is in motion the driver is the only man required. Unless they are there to hold the load on, more men are "excess baggage". Additional men are often sent with the truck to help unload it because the material is too heavy for one man to handle. This necessity may be



Sheet No. 1 **Observations**

Study No. 7 Date 5-1-24

Truck No. 2 Type Platform No. Men 2

Operators' Check Nos. 280 263 Truck Assigned to Storeroom "A" (SRA)

Arrived			Load & Unload		Departed		Material	Route	Delays
Section	Time	Load	Start	Finish	Time	Load			
SRA	7:12	E	7:14	7:18		0.8L	Cstgs	CS-REC.BLVD MO30 MI1	
MI-1	7:25	0.8L	7:305	7:35	7:365	0.4L	"	↑-MC AISLE MC4	WAIT FOR ELEVATOR
MC-4	7:38	0.4L	7:395	7:405	7:425	0.25L	"	MC AISLE MC1	
MC-1	7:435	0.25L		7:44		0.24L	"	BLVD-MO BLDG → MO30	3 Min at MO ELEV.
MO-30	7:51	0.24L		7:52		E		↑-BLVD. REC CS-SRA	3 Min at MO ELEV.
SRA	8:04	E	8:06	8:095		L	3 LONG FRAMES	CS-P7-R-S4	
S-4	8:135	L	8:16	8:17		E		R-P7-CS SRA	
SRA	8:215	E	8:22	8:25		0.8L	Cstgs.	CS-P7-R S4	5-Min.
S-5	8:29	0.8L		8:30		0.55L	"	S	
S-4	8:305	0.55L	8:405	8:31		E		R-P7-CS SRA	2 Min. (IND. RR)
SRA	8:38	E	8:51	8:43		0.7L	Cstgs.	CS-P7	1 Min. AISLE BLKD.
P-7	8:48	0.7L		8:56		0.25L	"	S5-49↑-T7	MTL. CHECKED AS UNLOADED
T-7	8:595	0.25L		9:00		0.15L	"	Bridge-W5	
W-5	9:03	0.15L		9:04	9:05	E		E-11-24↑-REC CS-SRA	1.5 Min. ELEV # 24
SRA	9:10	E	9:11	9:135		0.75L	Cstgs.	CS-K10	
K-10	9:16	0.75L		9:165	9:195	0.6L	"	K-10	
K-30 CstgSR	9:20	0.6L		9:205		0.45L	"	C-2↑-F1	1 Min IND RR 1 Min ELEV #2

Sheet No. 2 **Observations**

Study No. 7 Date 5-1-24

Truck No. Type No. Men

Operators' Check Nos. Truck Assigned to

Arrived			Load & Unload		Departed		Material	Route	Delays
Section	Time	Load	Start	Finish	Time	Load			
F-1	9:28	0.45L	9.285	9:31		E		2↑-A-C-CS-SRA	1-Min. Elev#2
SRA	9:405	E	9:425	9:485		L	7 LARGE COVERS	CS-P-7-R-P-1	
P-1	9.56	L	10:01	10:06		E		R-P7-CS-SRA	
SRA	10:12	E	10:12.5	10:16.5	10:17.5	L	5 TRANS TANKS & 10 COVERS	CS-REC-BLVD. SHIP.	
SHIPPING DEPT.	10.245	L	10:33.5	10:40	10:42	E		BLVD-REC.-CS-SRA	.5-Min
SRA	10:47.5	E	10:49	10:53.5		L	6 LARGE RINGS	CS-REC.-P7-R-S4	
S-4	10:57.5	L	10:58	11:01.5		E		R-P7-REC-CS-SRA	
SRA	11:05.5	E						CS-L11	
			LUNCH	PERIOD					
SRA	12:15	E	12:18	12:23		L	16 SMALL RINGS	CS-P7-S4	3.5 Min. IND. R.R
S-4	12:32	L	12:33	12:39		E		P7-CS	.5-Min.
SRA	12:43.5	E		12:45		0.8L	BAGS OF CSTG.	CS-K-10	
K-10	12:48	0.8L	12:49	12:50		E		CS-SRA	
SRA	12:53	E	12:54.5	12:56		0.6L	SCRAP CSTG.	Yard C.Sc.	
Copper Scrap	12:59	0.6L	1:03.5	1:04.5	1:05	E		Yard-SRA	
SRA	1:07	E							

FIG. 1 OBSERVATION SHEETS FOR RECORDING DETAILS OF TRUCK OPERATION

avoided by the installation of handling equipment, by securing the necessary manual assistance in the department receiving the material, or by using elevating platform trucks in connection with skids or trays.

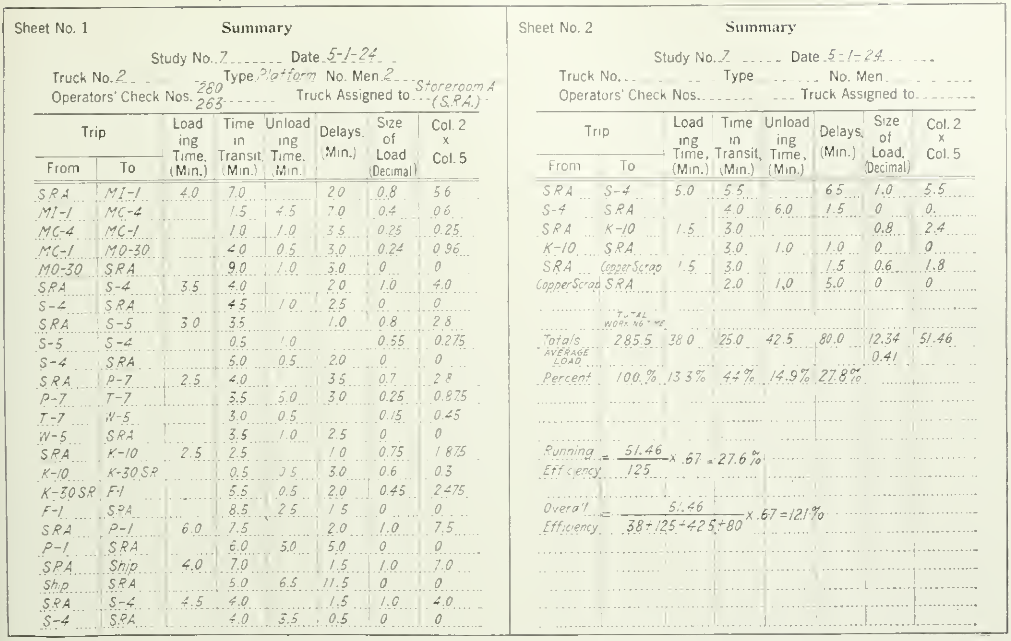
Minimum of Delays. The importance of keeping delays at a minimum cannot be overestimated. Each one in itself may be insignificant, but in the aggregate they amount to a considerable portion of the total working time of the truck. There are enough delays that cannot be anticipated or controlled, so that all possible attention should be given those that can be controlled, such as waiting for elevators, waiting for cranes, obstructed aisles, and indefinite loading and unloading instructions.

Minimum Handling Time. It is not an uncommon condition to have the actual running time of the truck exceeded by the handling time—loading and unloading. Handling time may be minimized by using skids and trays with elevating platform trucks. Thus, the truck is not necessarily standing idle while the load is being placed upon or removed from the skid. Hoists, cranes, and conveyors are frequently of considerable assistance. Material can be accumulated in large containers fitted with lugs or eyes for crane hooks and thereby lifted to the truck platform.

To say that a truck is operating at a definite percentage of efficiency, without explaining at the same time the standards upon which that efficiency is based, may be very misleading. Standards are generally arbitrary so that it is quite possible for one person to study and analyze the performance of a truck and conclude that it is 50 per cent efficient, according to his standards, while another person who assumes different standards may say it is but 10 per cent efficient. And in spite of the wide variation in actual figures, both may be as nearly right, according to their respective standards, as it is possible to express truck efficiency in figures.

The standard or 100 per cent performance may be determined in different ways. A study may be made to determine a reasonable daily mileage and that taken as 100 per cent, with which all other performances are compared. Where a truck is doing repetition work, hauling the same kind of material all day long over a prescribed route, the standard may be set according to the number of trips daily or in the nature of a time value per trip. In other cases truck performance is measured on a tonnage basis. All of these methods, however, involve some sort of a checking system which requires a measurement of performance, and this measurement, whether it be one of time, distance, weight or count, must be approximately correct, which entails considerable clerical work.

In using such standards, it is necessary to have standardized methods and conditions, which are considerably more difficult to attain in connection with trucking than with manufacturing operations on account of the great variety of material handled. It must be remembered also that manufacturing methods and facilities are in a continual state of improvement. Hence, today we may adopt a standard of performance which has never been attained in the past, call that 100 per cent, and tomorrow find that our standard has been equaled and passed, making it necessary, if the same standard is retained, to express efficiency by means of a figure greater than 100 per cent. This



Sheet No. 1 **Summary**

Study No. 7 Date 5-1-24

Truck No. 2 Type Platform No. Men 2

Operators' Check Nos. 280 263 Truck Assigned to Storeroom A (S.R.A.)

Trip From	Trip To	Loading Time, (Min.)	Time in Transit, (Min.)	Unloading Time. Min.	Delays. (Min.)	Size of Load (Decimal)	Col. 2 x Col. 5
SRA	MI-1	4.0	7.0		2.0	0.8	5.6
MI-1	MC-4		1.5	4.5	7.0	0.4	0.6
MC-4	MC-1		1.0	1.0	3.5	0.25	0.25
MC-1	MO-30		4.0	0.5	3.0	0.24	0.96
MO-30	SRA		9.0	1.0	3.0	0	0
SRA	S-4	3.5	4.0		2.0	1.0	4.0
S-4	SRA		4.5	1.0	2.5	0	0
SRA	S-5	3.0	3.5		1.0	0.8	2.8
S-5	S-4		0.5	1.0		0.55	0.275
S-4	SRA		5.0	0.5	2.0	0	0
SRA	P-7	2.5	4.0		3.5	0.7	2.8
P-7	T-7		3.5	5.0	3.0	0.25	0.875
T-7	W-5		3.0	0.5		0.15	0.45
W-5	SRA		3.5	1.0	2.5	0	0
SRA	K-10	2.5	2.5		1.0	0.75	1.875
K-10	K-30 SR		0.5	0.5	3.0	0.6	0.3
K-30 SR	F-1		5.5	0.5	2.0	0.45	2.475
F-1	SRA		8.5	2.5	1.5	0	0
SRA	P-1	6.0	7.5		2.0	1.0	7.5
P-1	SRA		6.0	5.0	5.0	0	0
SRA	Ship	4.0	7.0		1.5	1.0	7.0
Ship	SRA		5.0	6.5	11.5	0	0
SRA	S-4	4.5	4.0		1.5	1.0	4.0
S-4	SRA		4.0	3.5	0.5	0	0

Sheet No. 2 **Summary**

Study No. 7 Date 5-1-24

Truck No. Type No. Men

Operators' Check Nos. Truck Assigned to

Trip From	Trip To	Loading Time, (Min.)	Time in Transit, (Min.)	Unloading Time, (Min.)	Delays, (Min.)	Size of Load, (Decimal)	Col. 2 x Col. 5
SRA	S-4	5.0	5.5		6.5	1.0	5.5
S-4	SRA		4.0	6.0	1.5	0	0.
SRA	K-10	1.5	3.0			0.8	2.4
K-10	SRA		3.0	1.0	1.0	0	0
SRA	Copper Scrap	1.5	3.0		1.5	0.6	1.8
Copper Scrap	SRA		2.0	1.0	5.0	0	0
	TOTAL WORKING TIME						
Totals	285.5	38.0	25.0	42.5	80.0	12.34	51.46
AVERAGE LOAD						0.41	
Percent	100.%	13.3%	44%	14.9%	27.8%		

$$\text{Running Efficiency} = \frac{51.46}{125} \times .67 = 27.6\%$$

$$\text{Overall Efficiency} = \frac{51.46}{38+125+42.5+80} \times .67 = 12.1\%$$

FIG. 2 SUMMARY SHEETS FOR CALCULATION OF DATA FROM OBSERVATION SHEETS

then becomes misleading, for we are apparently better than perfect, a condition, of course, impossible.

In a technical sense, as well as in a general sense, 100 per cent means perfection, and perfection cannot be improved upon. No mechanical device has ever been produced, no system has ever been devised, that will operate continuously at 100 per cent efficiency. Therefore, why not take *theoretical* perfection as 100 per cent? Then we are certain of having a standard which we can never meet as a practical matter, but which we can always approach. It will never be necessary or possible to change it without going back and changing one or more of the original hypotheses upon which it was founded.

What is theoretical perfection? Going back to our list of factors that determine efficiency, let us consider them in the order given. First, maximum loads are *full* loads. Maximum running is *all* of the time. Minimum of empty trips is *no* empty trips. Minimum damage is *no* damage. Minimum of men to operate a truck is *one* man. Minimum of delays is *no* delays. Minimum of handling time is *no* handling time. Thus we have our ideal truck operating at 100 per cent efficiency when it is carrying *full* loads, *safely*, *all* of the time with *no* delays or handling time and operated entirely by *one* man.

As previously stated, many of the above standards are absolutely impossible in practice. For instance, no one would ever seriously contend that handling time could be reduced to absolute zero. To do so would mean that material would have to be loaded and unloaded while the truck was in motion. On the other hand, who is prepared to define any limit beyond which we shall never go in approaching that absolute zero? If trays and skids were used exclusively with lift-trucks, the handling time would be almost negligible. Likewise, delays could never be entirely eliminated but they can nearly always be reduced.

With such standards it will be readily appreciated that a percentage figure which seems low numerically may be actually reflecting a relatively normal or average condition.

It will be noted that all of our so-called "efficiency factors" are of such a nature that each point may be readily checked by an observer, riding or following the truck, without in any way interfering with, or handicapping the operator. There is no necessity of introducing the delays incident to measuring, weighing, or in any way checking the load. It is only necessary to decide by observation the degree to which the truck is loaded. It may be said that errors in judgment may be introduced. This is possible, but it is felt that these errors are so slight as to be negligible, since the observers used on this work are high-grade technical men.

The analysis of truck performance falls into two divisions, namely, observations and calculations.

The observations are taken by a man who stays with the truck for a period of a full day or more. He makes a complete record of the activity of the truck over the period of the study, noting time of arrival and departure, cause and duration of delays, loading and unloading time, size of load and route of each trip. A "trip" is here used as involving only two successive stops. Hence, to make a delivery from one department to another requires two "trips," one going and one returning, or one to and another from the department.

To illustrate better the method of recording observations, a portion of an actual study, covering a little over a half day, is reproduced in Fig. 1.

It will be noted by the heading on the form that this study was made on May 1, 1924; that it is on Truck No. 2 which is of the platform (non-elevating) type; that there were two men employed on it—a driver and a helper; and that it is assigned to "Storeroom A," which is a casting storage.

Details of Observations

The first observation shows that the truck arrived at "Storeroom A" (SRA) at 7:12 A. M. (time shown in column 2). The "E" in column 3 indicates that the truck arrived empty. There was a delay of 2 min. (between 7:12 and 7:14) for receiving loading instructions. Loading was started at 7:14 and completed at 7:18. The truck departed immediately, so no time entry is recorded in the "Departed" column, it being understood when no time is shown that the last recorded time is to be used. However, the size of load taken away is recorded, being in this case 8/10 of a load, as indicated by "0.8L". The material was castings.

In recording the route followed, the starting point is not indicated and only those intersections where there is a possible choice leading to the same destination are shown. Abbreviations are used which make the route perfectly clear to anyone familiar with the plant layout and building and departmental designations. The purpose of recording the route taken is to find out if the most practicable route is being followed. The most direct is not always the best. It may lead through a very congested part of the shop, which a slight detour would avoid. When elevators are used, they are indicated by arrows pointing either upward or downward, as the case may be, and the elevator number is recorded with the arrow, where there is more than one in the same building.

Route Followed by Truck

In the case of the first trip recorded on the sample study (from SRA to MI-1), the interpretation of the route symbols is as follows: Storeroom A, to Crane Shed, to Receiving Department, to Boulevard, to Section MD, up elevator No. 107, landing at the first destination, Section MI-1. Time of arrival at MI-1 is recorded (7:25) as well as size of load (0.8L) which is the same as it was on departure from SRA. Part of this load is left at MI-1 and the remainder distributed to three other departments in the same vicinity, namely, MC-4, MC-1, and MO-30, before returning to SRA for another load. The study is continued in this manner over a long enough period of time to insure its reflecting representative conditions for that particular truck.

An analysis is then made of the study and the results are summarized on a form designed for the purpose. Fig. 2 shows the conclusions and summary of the study discussed above. The total time for each trip is distributed into loading time, transit time, unloading time and delays, in columns 3, 4, 5 and 6 respectively.

If a truck arrives at a department empty and departs with a load, it is obvious that any handling time must be loading time. In the case of the first trip (from SRA to MI-1) the loading time was 4 min. (the difference between 7:14 and 7:18) as recorded in column 3 of the summary sheet. Time in transit is found by subtracting time of departure from one station (column 6 on observation sheet) from the time of arrival at the next station (column 2), deducting any delays that might have occurred between the two stations.

Where no reading is recorded in a time column, it is understood that the immediately preceding time reading is to be used. Thus on the first trip the departure time was 7:18, there having been no delay between the completion of putting on the load and departure. On the second trip, however, there was one delay of 5.5 min. immediately following arrival (between 7:25, time of arrival at MI-1, and 7:30.5, time that unloading was begun), and another delay of 1.5 min. after the unloading was completed (between 7:35, when the material for MI-1 had been unloaded and 7:36.5 time of departure). These delays are usually due to the necessity of the trucker getting receipts signed or waiting for loading or unloading instructions. Delays in transit are frequently due to waiting for elevators, crane lifts, or because of congestion in the aisles. They are all aggregated for each trip and entered in column 6 of the summary sheet.

Figuring the Full Load Equivalent

The size of the load carried on each trip, as expressed decimally, is carried over from the observation sheet to column 7 on the summary sheet. The load decimal is then multiplied by its corresponding transit time (column 7 times column 4) which results in a factor (column 8) which is termed "full load equivalent". It is so termed because both the size of the load and the length of time in transit are taken into account. A full load carried the resultant number of minutes would be equivalent to the actual decimal part of the load being carried the actual full time. Hence, the "full load equivalent" on the first trip was 5.6 min. ($0.8 \times 7 = 5.6$) because carrying 0.8 of a load for 7 min. is equivalent to carrying a full load 5.6 min.

It will be readily seen that the running efficiency of any single trip could be found by dividing the "full load equivalent" by the actual transit time. But for the present we are not as much interested in the individual trip efficiencies, which would range everywhere from zero to 100 per cent, as in truck efficiency over a period of time. Therefore, all columns are totaled and efficiency is calculated in two ways, namely—running efficiency and overall efficiency. The latter is a more accurate reflection of conditions as a whole, since the entire working time is considered, whereas, only transit time is considered in the former.

It is also necessary to consider the number of men assigned to the truck. Needless to say, a truck with but one man, the operator, is a more efficient transportation unit than one with two men, provided the amount of work each one does is comparable. The additional man will reduce handling time, it is true, but at other times

Date *4-18-24*

Truck No.	No. of Men	Size of Load: E	$\frac{1}{8}$	$\frac{1}{4}$	$\frac{1}{2}$	$\frac{3}{4}$	Full	Material
3	2	✓						
74	2	✓						
69	2					✓		Coils
67	1	✓						
41	2	✓						
7	1		✓					Tote Box
67	1						✓	Coils
46	2				✓			Reels of Wire
20	1	✓						
5	2		✓					Tote Box
68	1							
11	2					✓		Boxes

FIG. 3 OBSERVATION SHEET FOR APPROXIMATE METHOD

he is unnecessary, and surplus weight for the truck to haul around. The cost of operating a truck including depreciation, interest, maintenance, and other running expenses is somewhat less than the operator's wages. Time is saved in handling when a second man is assigned to the truck. With two men on a truck the combination is regarded, for practical purposes, as three equal units—two men and one truck. But the efficiency of a truck is inversely proportional to the number of units making up the combination, so when a truck carries two men it is two-thirds as efficient as when it carries only the operator. Therefore, a multiple of 0.67 is introduced when there are two men, as in the accompanying example.

Formulas for Efficiency

Then, "running efficiency" may be found by means of the following formula, where:

F = Total of full load equivalents
T = Total transit time
E_r = Running efficiency
0.67 = Factor when 2 men are employed.

$$E_r = \frac{F}{T} \times 0.67, \text{ or in our example:}$$

$$= \frac{51.46}{125} \times 0.67, = 27.6 \text{ per cent}$$

Overall efficiency may be calculated from the following formula, where:

F = Total of full load equivalents
L = Total loading time
T = Total transit time
U = Total unloading time
D = Total delays
E_o = Overall efficiency
0.67 = Factor when 2 men are employed

$$E_o = \frac{F}{L+T+U+D} \times 0.67$$

or, when applied to the accompanying example,

$$= \frac{51.46}{38+125+42.5+80} \times 0.67 = 12.1 \text{ per cent}$$

For purposes of comparison the distributed working time is also expressed in terms of percentage as shown on the summary sheet, in which case we find the following:

Loading time	13.3 per cent
Transit time	44.0 per cent
Unloading time	14.9 per cent
Delays	27.8 per cent
Total	100.0 per cent

The value of these figures standing alone for but one truck is, of course, of secondary importance. The real object is accomplished when similar figures are secured for all trucks. Then, by comparison, it is a simple matter to locate the weak spots that require further detailed attention and remedial action. Furthermore, the individual results may be so combined as to express the general efficiency of any particular group or of the entire fleet of trucks operating in the plant.

The results of the foregoing example, when compared with the average figures for 21 other trucks and for the best truck of that type, make a very favorable showing. See Table 1.

TABLE 1. TIME DISTRIBUTION AND EFFICIENCIES OF TRUCKS

ITEM	AVERAGE FOR 21 TRUCKS PER CENT	BEST PLATFORM TRUCK PER CENT	TRUCK NO. 2 (EXAMPLE) PER CENT
Loading time	15.3	15.1	13.3
Transit time	38.4	49.2	44.0
Unloading time	13.0	14.2	14.9
Delay time	33.3	21.5	27.8
Total	100.0	100.0	100.0
Running efficiency	28.5	41.7	27.6
Overall efficiency	10.9	20.5	12.1

Frequently a special study and analysis of one or more trucks is requested by the head of a department, in which case the results are submitted in the form of a report. An example of such a report prepared on the operation of Truck No. 64 is presented below.

REPORT ON AUTO-TRUCK NO. 64

June 17, 1924

This report is a resumé of the performance of Truck No. 64. It is of the low platform type, the crew consisting of an operator and helper. The study was made on the sixth and on the ninth of June, covering 466.5 min., or the equivalent of about one day's work.

The data taken include the sections between which trips were made, the time of arrival and departure, the time consumed in loading and unloading, the estimated per cent load, the material making up the load, the route followed, and the length and cause of delays.

The study is segregated into trips between sections, and the time is divided under the headings of loading time, time in transit, unloading time, and delays. The totals of these items are converted into percentages of the total time. The transit time for each trip multiplied by the per cent load, gives a factor used in calculating the running and overall efficiencies.

For the purpose of comparison, the results for Truck No. 64 are listed below, together with the average of all trucks studied, and the figures for the best platform truck.

	PER CENT OF TIME IN				EFFICIENCIES	
	Loading	Transit	Unloading	Delay	Running	Overall
Best truck	15.1	49.2	14.2	21.5	41.7	20.5
Average all trucks	15.3	38.4	13.0	33.3	28.5	10.9
Truck No. 64	5.7	44.8	10.1	39.4	10.5	4.7

The percentage distribution of time is self-explanatory. The aim is to make the transit time a maximum and the others a minimum. However, the per cent of time in transit does not indicate how much work the truck is doing while in motion. In fact, in the present case, while the per cent of time spent in transit is high, the efficiencies are the lowest obtained in any of the trucks studied. The reason for the high per cent of time spent in transit was partly due to the operator, who did not seem to have a favorable attitude toward the study. The truck was consistently run at a retarded speed and unnecessarily roundabout routes were followed. The loading and unloading times were quite low, the former being considerably lower, due to the better facilities for loading. The amount of time lost in delays was quite high, and was due to waiting for orders, getting slips signed, waiting for cranes and elevators. Ten different elevators were used by the truck, and nearly a quarter of the delay time was consumed waiting for elevators.

In comparing efficiencies, the standard or 100 per cent efficiency must be taken into account. The 100 per cent overall efficiency is that of a fully loaded truck, with but one operator, running continuously. This ideal condition would be most nearly met with a lift-truck carrying fully loaded trays between all stops. Where a helper accompanies the truck a factor of 2/3 is used as a multiplier in finding the efficiency.

The running or "load" efficiency takes account of the size of the load, with regard to the time the load is in transit. It is the sum of the products of individual loads and times in transit, divided by the total transit time. This is multiplied by 2/3 when two men accompany the truck. The overall efficiency, then, is the product of this running efficiency and the per cent time in transit. The absolute values of the efficiencies do not have much significance, these figures being chiefly valuable for comparison.

A rough and ready method of arriving at a general indication of the efficiency of the entire trucking system is sometimes resorted to, although it is by no means a substitute for the method to which this article is mainly devoted. Its chief advantage is that the result can be secured quickly and frequently, serving, in a sense, as a barometer of trucking conditions. At best, it will tell only whether the general efficiency is high or low, but it does not point out the inefficient truck. It is of value when it is desired to know the effect of any general influence, such as fluctuating business conditions, increase or decrease in production, etc.

The results are based entirely upon the size of loads carried, no account being taken of length or time of trips, delays, or handling time. It is assumed that if all trucks are well loaded and if the percentage of empty trips is small, that other conditions will also be good. In general, this is true, but exceptional cases may be found that would indicate a fallacy in such reasoning. However, when such figures are determined from data extending over a sufficiently long period of time, it is fairly safe to compare them with other similar figures derived, at intervals, in the same manner.

An observer stations himself at an important traffic intersection or at a point on a heavily traveled thoroughfare. He notes every passing truck, recording the truck number, number of men, approximate size of load and a remark about the material. Fig. 3 shows a sample observation form.

When the observations are completed the numbers in each column are counted showing how many empty trucks were observed; how many carried one-eighth of a load or less; how many a quarter of a load and so on. Each total is then multiplied by the decimal representing the size of the load. The sum of these products is then divided by the total number of observations, securing a general efficiency percentage. As in the other method, the factor of 0.67 is used when there are two men on the truck.

The results of a study of this sort covering 126 observations are shown in Table 2. The readings taken are figured into three results, all of which are necessary to a satisfactory determination of the effective use of trucks.

TABLE 2. CALCULATIONS OF TRUCK EFFICIENCIES BY THE APPROXIMATE METHOD

SIZE OF LOAD	TOTAL NO. OBSERVATIONS	ONE MAN ON TRUCK		TWO MEN ON TRUCK	
		No. Obs. ×Load	Decimal	No. Obs. ×Load	Decimal
Empty	52	26 ×0	= 0.00	26 ×0	= 0.00
1/8 load	12	4 ×0.125	= 0.50	8 ×0.125	= 1.00
1/4 load	8	3 ×0.25	= 0.75	5 ×0.25	= 1.25
1/2 load	7	0 ×0.50	= 0.00	7 ×0.50	= 3.50
3/4 load	16	6 ×0.75	= 4.50	10 ×0.75	= 7.50
Full load	31	17 ×1.00	=17.00	14 ×1.00	=14.00
Totals	126	56	22.75	70	27.25
Class efficiency		$\frac{22.75}{56}=41.6$ per cent		$\frac{27.25}{70}\times 0.67=26.0$ per ct.	
Average efficiency		$\frac{22.75+(0.67\times 27.25)}{126}=\frac{40.95}{126}=32.5$ per cent			
Average size of load		$\frac{22.75+27.25}{126}=\frac{50}{126}=39.7$ per cent of full load			

The study further showed that the total of 126 observations was distributed, according to size of load, from empty to full, by quarters, as follows:

Empty	41.3 per cent	1/2 load	5.6 per cent
1/8 load	9.5 per cent	3/4 load	12.7 per cent
1/4 load	6.3 per cent	Full load	24.6 per cent

Modern Methods of Truck Testing

By W. L. DAY

President and General Manager, General Motors Truck Company

MOTOR trucks are a very important part of the transportation system of the country. A considerable part of the short haul freight formerly handled by the railroads is now carried on motor trucks. For city delivery work motor trucks have largely replaced horse-drawn vehicles. The building of good roads and the improvement of motor truck design and construction have resulted in an extension of motor trucking until it is second only to the railroads in importance as a means of transportation.

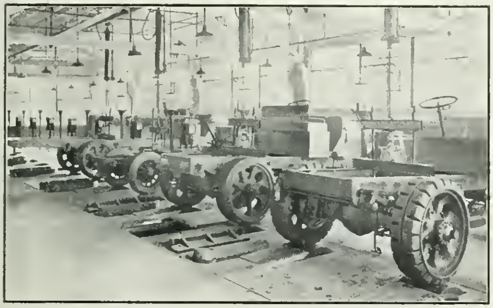


Fig. 1 General View of Testing Department

Index Number
629.113(072) Motor trucks.
Tests

This increased use of motor trucks has been made possible by the activities of motor truck manufacturers. Motor trucks are machines and must be operated at a profit to their owner just as must any other piece of equipment.

Steady and reliable performance are essential to profitable operation, and since motor trucks are run almost continuously during the working day—often much longer—to insure good service is a difficult task.

The work required of a motor truck, if it is to perform efficiently over a period of years, makes it necessary to construct it of good materials, accurately fitted by skilled workmen using the highest grade machinery and tools. Accuracy is a very important factor in the manufacture of motor trucks if the trucks are to give efficient service during a long life. In our own factory the gages for measuring the accuracy of the parts represent an investment of a quarter-million dollars.

After a truck is completed it should be tested to see if its performance is satisfactory. Believing that tests are a very important part of motor truck manufacture, if all trucks produced are to give uniformly good service, we have adopted a method of testing which is much more accurate than the method in more general use.

The old way, and the common way, was to load a

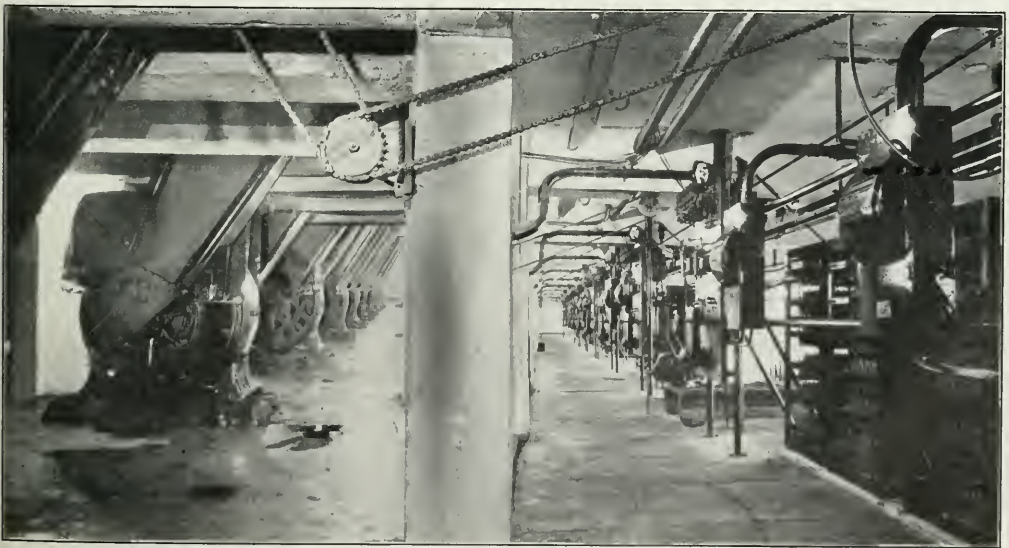


Fig. 2 General View Showing Equipment on Gallery Under Testing Floor

chassis with test weights and send it out with a driver to be run for a given time over the roads and note its performance. As few motor trucks are provided with speedometers it is easy to see that the distance traveled could be checked only by the report of the driver. The same thing was true as to consumption of oil and gasoline, condition of the engine under various speeds, etc.

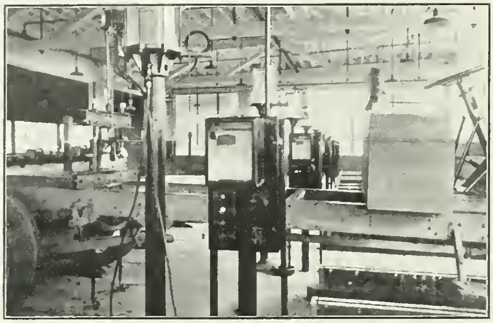


Fig. 3 Gasoline and Oil Reservoirs, Speedometer, and Recording Instrument

Since such a method of testing requires a driver for each truck the expense with quantity production, and the difficulty of securing competent and reliable drivers are apparent. About two years ago we installed in our factory a complete set of testing apparatus with a capacity of 100 trucks daily.

New Method of Testing Trucks

The trucks are tested for gasoline consumption, ignition, carburetor adjustment, oil distribution, water circulation, speed, horsepower developed at the rear wheels, and for friction in all sections of the chassis. Every instrument known to modern automobile engineering science for the testing of automobiles has been installed. The trucks, when they come off the assembly train and are passed by inspectors, are run to the testing department a short distance from the assembly line and run onto one of the blocks. (Fig. 1). The front wheels are held in place by automatic jacks which catch as the rear wheels are driven up onto two rollers, and the jacks in front are so placed that they can accommodate any wheel base desired.

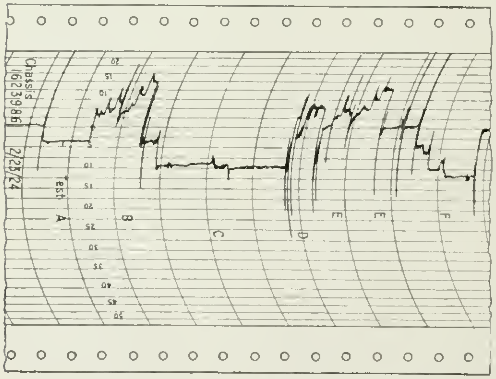


Fig. 4 Automatic Chart Which Shows the Relation of Friction to Speed, and Power Developed by Motor

The rear wheels of the truck rest on the two rollers, which are connected and driven for friction test by a 50 hp. electric motor in a gallery just below the floor. (Fig. 2). These motors, in addition to driving the wheels of the truck on the dynamometer test block, are dynamos, and generate electricity when the truck motor is run, which in turn is sent through electrical apparatus and carried back into the factory, where it is converted into use as power.

At the left of the truck on the dynamometer are the test instruments and control board. (Fig. 3). A visible gasoline tank is also connected with the truck and the pipe run directly to the carburetor line. The glass tank is marked off in half-gallon units so that an accurate check of the consumption can be kept. This tank is filled automatically from above by simply pulling a chain, which is connected with a pipe to a main tank, supplying all blocks.

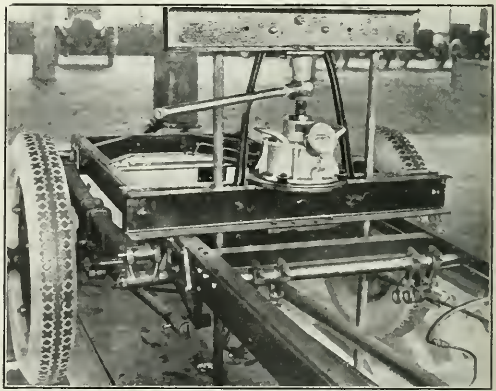


Fig. 5 Method of Applying the Load

In front of the truck is a swinging hose, suspended from the ceiling so that water can be replenished in the radiator at will. A check is also kept on oil consumption in the same manner that the gasoline consumption is watched. A metal hose is attached to the exhaust pipe of each truck, and this is run down through the floor and exhausted into the air through separate ducts. Also, in order to avoid engine gases, there is installed over each test block a ventilator, which can be opened or closed at will.

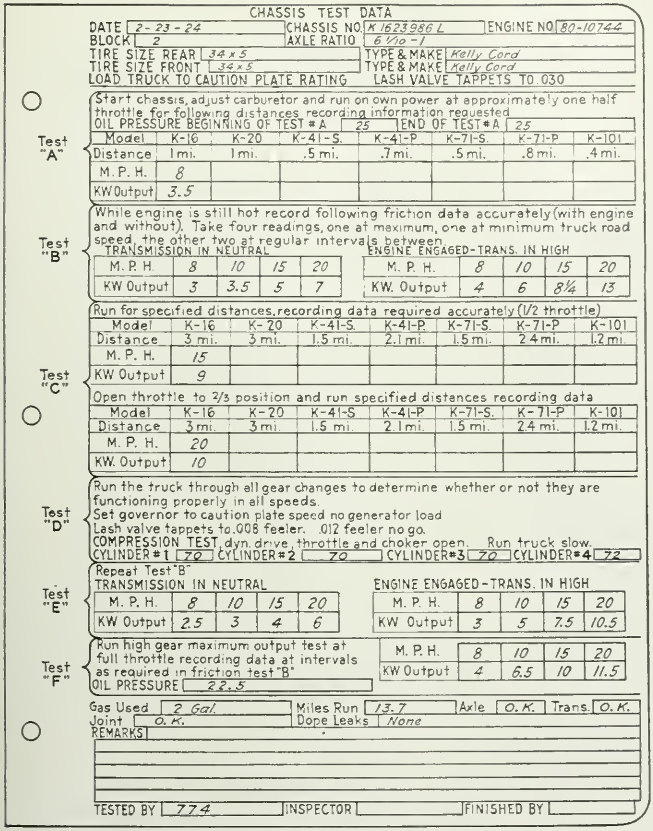
Recording Instruments Used

Above the control board at the left of the truck is a speedometer, showing the miles per hour a truck is being driven, the miles it has been run, and this is used in connection with the checking up of gasoline and oil mileage. This speedometer is driven by a flexible shaft leading to the main drive shaft of the rolls.

Also, just above the controls, is an automatic chart which shows the relation of friction to speed, whether it be in high or low range of the transmission or in reverse. It also shows the friction in the motor, which can be run in direct drive at high gear without firing and driven by the dynamometer motor, through the rear wheels. Again, this chart shows the power developed by the motor as it is tested out, firing, in all three speeds and reverse, and an automatic pen and red ink marks the fluctuations of the power on ruled paper, which is controlled by clock arrangement. (Fig. 4).

Below this chart are the controls which slow or speed up the dynamometer at will, and safety devices for protection. Suspended from the ceiling at the rear of the truck and directly over the cross member on the frame is a jack, with an automatic indicator by means of which the load, corresponding to actual road tests, is applied. (Fig. 5). This jack is controlled by compressed air, and by turning a handle it is possible to apply a load from one to ten or more tons, directly over the rear wheels. The rollers on which the rear wheels rest are so constructed that a road condition, with the exception of the bumps, is maintained.

The results of this mechanical testing are far more satisfactory than where the human element must be depended upon. Furthermore, the record sheets (Fig. 6) are all filed away so that it is possible at any time in the future to look up the test record on any trucks we have built.



CHASSIS TEST DATA

DATE 2-23-24 CHASSIS NO. K 1623986 L ENGINE NO 80-10744
BLOCK 2 AXLE RATIO 6 1/10 - 1
TIRE SIZE REAR 34 x 5 TYPE & MAKE Kelly Cord
TIRE SIZE FRONT 34 x 5 TYPE & MAKE Kelly Cord
LOAD TRUCK TO CAUTION PLATE RATING LASH VALVE TAPPETS TO .030

Test "A"

Start chassis, adjust carburetor and run on own power at approximately one half throttle for following distances recording information requested
OIL PRESSURE BEGINNING OF TEST # A 25 END OF TEST # A 25

Model	K-16	K-20	K-41-S.	K-41-P	K-71-S.	K-71-P	K-101
Distance	1 mi.	1 mi.	.5 mi.	.7 mi.	.5 mi.	.8 mi.	.4 mi.
M. P. H.	8						
KW Output	3.5						

Test "B"

While engine is still hot record following friction data accurately (with engine and without). Take four readings, one at maximum, one at minimum truck road speed, the other two at regular intervals between.

TRANSMISSION IN NEUTRAL

M. P. H.	8	10	15	20
KW Output	3	3.5	5	7

ENGINE ENGAGED-TRANS. IN HIGH

M. P. H.	8	10	15	20
KW. Output	4	6	8¼	13

Test "C"

Run for specified distances, recording data required accurately (1/2 throttle)

Model	K-16	K-20	K-41-S.	K-41-P.	K-71-S.	K-71-P	K-101
Distance	3 mi.	3 mi.	1.5 mi.	2.1 mi.	1.5 mi.	2.4 mi.	1.2 mi.
M. P. H.	15						
KW Output	9						

Open throttle to 2/3 position and run specified distances recording data

Model	K-16	K-20	K-41-S	K-41-P.	K-71-S.	K-71-P	K-101
Distance	3 mi.	3 mi.	1.5 mi.	2.1 mi.	1.5 mi.	2.4 mi.	1.2 mi.
M. P. H.	20						
KW. Output	10						

Test "D"

Run the truck through all gear changes to determine whether or not they are functioning properly in all speeds.
Set governor to caution plate speed no generator load
Lash valve tappets to .008 feeler. .012 feeler no go.
COMPRESSION TEST, dyn. drive, throttle and choker open. Run truck slow.
CYLINDER # 1 70 CYLINDER # 2 70 CYLINDER # 3 70 CYLINDER # 4 72

Test "E"

Repeat Test "B"

TRANSMISSION IN NEUTRAL

M. P. H.	8	10	15	20
KW Output	2.5	3	4	6

ENGINE ENGAGED-TRANS. IN HIGH

M. P. H.	8	10	15	20
KW Output	3	5	7.5	10.5

Test "F"

Run high gear maximum output test at full throttle recording data at intervals as required in friction test "B"
OIL PRESSURE 22.5

M. P. H.	8	10	15	20
KW Output	4	6.5	10	11.5

Gas Used 2 Gal. Miles Run 13.7 Axle O. K. Trans. O. K.
Joint O. K. Dope Leaks None
REMARKS

TESTED BY 774 INSPECTOR FINISHED BY

Fig. 6 Specimen of Sheets Used for Test Records of Any Trucks Built

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Handling $12,000,000 Worth of Stores a Year

By E. HARTY

Index Number
658.78 Material control

THE stores department of the Southern Pacific Company has built and placed in service at Sacramento the first unit of what is to be one of the largest facilities devoted to storage and distribution of railroad materials in the country. The two structures already erected consist of a main store building of two floors, 500 ft. long, with platforms making it 700 ft. long in all, and a fireproof oil house equipped with complete handling equipment.

The first floor of the main building serves as a warehouse where materials are stored in original package lots ready for shipment to other stores, thus saving the cost of packing. The second floor contains materials stored in racks for delivery to local shops, for equipping the three supply trains operating from this storehouse, and for shipment to smaller branch storerooms. In all there are 82 racks, or nearly five miles of shelving.

Materials are divided into sections, or departments, similar to the arrangement common in the best industrial stores practice. These sections are in charge of section stockmen, each one attending to ordering, receiving, storing, and issuing the materials coming under his jurisdiction.

Every item of material in stores is counted once each month. This count must be accurate for upon it the purchases for that month are based. Considering that these purchases may run as high as $1,500,000 monthly, the necessity for accurate count can be easily recognized.

To facilitate this monthly inventory, various methods are followed to secure a positively accurate inventory in the least possible time. Large items of materials are stacked in unit piles; sheet iron in piles has sheets numbered successively from bottom to top so that the top sheet always shows the number on hand; small materials on shelves are arranged in trays, a certain number in each tray, and these are stacked one upon another. Each tray shows the number of units in it and in all the other trays located vertically below it.

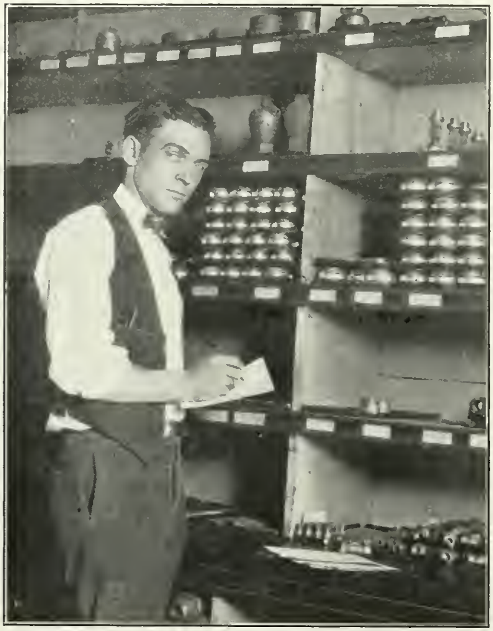


FIG. 1 STORES ARE LABELED, COUNTED, AND RECORDED

The oil house is a fireproof structure of concrete and steel. In the basement are the supply tanks of oil of various kinds. Self-measuring and registering hand-pumps are used to handle issues of small quantities, while power-pumps, which automatically measure and deliver amounts ranging from a barrel to several thousand gallons, handle the oils that are distributed to the line in supply trains.

The large manufacturing departments of the company are located here, and produce bar iron and steel, brass, iron and steel castings, tie plates, and many other materials, the total value of which amounts to over $4,000,000 yearly.

To supply these industries, the stores department operates the largest scrap assembling and classifying yard on the system. Here the accumulation of scrap from practically the entire railroad is sorted. Materials which can be placed in condition for further service are repaired and returned to stores. No item of material that can be repaired is overlooked; even old oil cans and used track spikes are returned to active service. Items which cannot be reconditioned are sorted and sent to the various manufacturing plants, for reuse in another form, or are sold to outside firms.

The activities of the department, in a large measure, are devoted to serving other branches of the railroad. In order to keep closely in touch with the needs of these operating branches, the storehouse, wherever possible, furnishes materials and supplies directly to the workmen. At the shops equipped with motor trucks, cranes, and industrial cars, all materials, ranging from huge locomotive cylinders down to ice for drinking water, are delivered right to the mechanics on the job.

This work extends beyond the immediate shops, and through the medium of supply train materials are delivered directly to the user all along the line. From Sacramento each month three of these large trains, carrying materials of every kind, including oils, lumber, etc., move east to Ogden, north to Portland, and south as far as Santa Barbara, making deliveries to the various units. At the same time they afford means of inspection and the obtaining of a personal knowledge of requirements, by division officials. This feature of personal contact of supply department and user brings about economy and efficiency.

In addition to the delivery of new supplies, these trains do the work of gathering the worn tools and other materials to be repaired, and collect the scrap for the manufacturing industries.

The outstanding feature of the delivery system is that it provides for regulation of quantities of materials stored on the line, reducing amounts to the point of actual requirements to carry on the work. It is thus possible to concentrate materials at central depots.

The accompanying photographs, Figs. 1 and 2, indicate the attention that is given the care of materials, which are stored in open racks in full view, and plainly marked, with the proper description, and quantity on hand showing at all times.

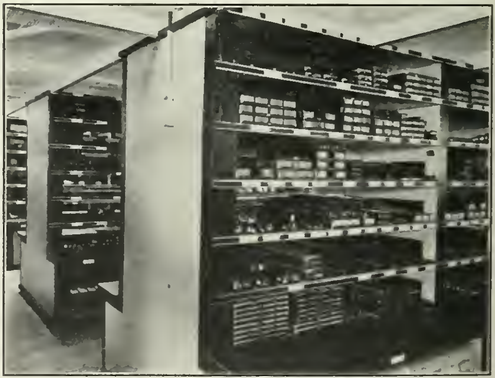


FIG. 2 ARRANGEMENT OF SHELVING IN STOREROOM

Around these central buildings are grouped the heavier materials, such as locomotive tires, wheels, castings, lumber, etc. The whole forms a stores handling operation ranging from $12,000,000 to $15,000,000 yearly, with a stock averaging $4,000,000 in value, and with 4,000 carloads of material received and a like number shipped as reconditioned supplies each year.

Management in the Clothing Industry

Market Analysis and Standardized Production Develop Stability

By SANFORD E. THOMPSON and WILLARD E. FREELAND

Consulting Engineer,
The Thompson and Lichtner Company.

Assistant Professor of Marketing,
Massachusetts Institute of Technology

THE real beginning of the ready-made garment industry took place during the Civil War. Just before that period the sewing machine had been introduced into various factory operations, but it was the discovery, in uniform manufacture for the soldiers, that there were certain relatively fixed standards in the sizes of men which gave the business its real start. The first ready-made garments for men's civilian wear were put on sale before the end of the war. Women's garments ready for wear came in more slowly, but today the ready-to-wear departments in the department stores are doing an increasingly large business, principally on account of the leadership of the manufacturers in the development of styles.

Concentration of Garment Factories

Garment factories tend to concentrate in the large cities where there is a fluid labor market. The concentration of the men's clothing industry is mainly in five cities: New York, 38.7 per cent (1919); Chicago, 15 per cent; Baltimore, 6.4 per cent; Philadelphia, 5.1 per cent; and Rochester, 3.3 per cent. The women's clothing industry is in three cities: New York, 69.3 per cent (1919); Philadelphia, 7.8 per cent; and Chicago, 4.1 per cent.

The number of establishments in the men's clothing industry in 1919 was 5254, and the value of the output $1,158,006,904. At one time it was quite common to sub-contract parts of the work to small specialized contractors, a condition which still persists in New York but is disappearing in other sections. In New York in 1919 there were less than 100 regular factories and about 1970 contract shops. Large-scale manufacturing is becoming common in the other cities, with a consequent interest in the development of better management policies and methods. The factories making women's clothing are not showing the same tendency in any marked way on account of the greater influence of the style factor and the rapidity of style changes.

Because of the innumerable small factories, the variety of racial characteristics of both owners and employees, and the seasonal nature of the industry, labor is the most important factor in production. Strikes are numerous both in individual shops and collectively. Piece rates, as discussed later, are usually a matter of bargaining or bartering. In certain lines the unions have forced an elimination of piece work altogether, with a resulting increase in manufacturing cost and a consequent curtailing of demand for the product. On the other hand, in several distinct cases union labor has shown a marked and intelligent co-operation in development of scientific methods and the establishment of standards of production.

Index Number
658.9:687 Clothing industry.
Management

The garment industry is noted for its protocols or agreements between manufacturers' associations and unions, occasioned by the large number of small factories in the various centers, and the consequent variety of demands both of employer and employed. While the main element culminating in these agreements has been the club—the threat and the fear of strike, and the demand for higher wage, or the cutting of rates—in certain instances there have been notable examples of co-operation aimed to arrive at really scientific determination of production standards and of management practice.

The first of these instances in New York City was in the dress and waist industry in 1916 under the leadership of Robert G. Valentine, whose untimely death prevented full realization of the developments. More recently in Cleveland, Ohio, in ladies' garment manufacture, the manufacturers and union have been working out problems of production with a view of evolving production standards. The outstanding feature of the agreement, however, has been the guarantee of work by the manufacturers for a certain period —about 40 weeks—in each year.

In Baltimore, also, co-operative action has played an important part in men's clothing manufacture.

A plan of particular interest from both labor and manufacturing standpoints, has been the development of production standards in Montreal. Here the developments were carried on by the manufacturer, with the advice of industrial engineers, but with the full co-operation of the international union which controls the activities of the garment workers of both the United States and Canada.

Management Policies

A characteristic policy of the outer garment industry with a few notable exceptions is to manufacture only to order and not for stock. The purchase of outer clothing by consumers is naturally seasonal and normally is delayed until the opening of the calendar season. Retailers, in their desire to lessen the style gamble as much as possible, will also delay their buying as long as possible. The result is a bunching of orders to the manufacturer and pressure for the quickest delivery he can make. Hence, seasonal and fluctuating production marks the whole industry.

The control of the market is largely in the hands of the distributors, and the average manufacturer is subjected in no small measure to their dictation. The importance of the style factor enters into this situation. The creative instinct of the manufacturer and the desire of the merchant to gain a reputation for style leadership in his community enter into partnership in the seeking for something new to offer the public and to entice trade away from competitors. It is frankly a play to gain from the psychological instinct for individuality, less pronounced in men than women, but nevertheless a real factor. The question of the economic soundness of substituting style for service is not raised, for volume of business obscures it.

In order to right this condition, the manufacturer must adopt aggressive selling methods to establish, as a few houses have done, a brand preference as a means to protect his market against competition. To enter into such a campaign, he must so manage as to control the quality, style, price, service, and delivery to market of his product, to the point where these factors give him a measure of protection against the inroads of competitors working toward the same goal.

Simplification and standardization of products are essential if the manufacturer hopes to gain mass production in marketing and the strength to escape from the dictation of his customers. In this respect the garment industry, even in men's clothing, is markedly backward, although there is before it the example of a few outstanding establishments which have most successfully pointed the way. The subject is of greater importance because it is along this way that escape lies from the evils of seasonal production. After all, the average consumer must seek the economy of service in his garments, and of necessity must welcome the combination of service and good appearance which the garment-maker can give him if his production can be stabilized. This can be done only by building up a demand which is not transient and which can be forecast to permit manufacture for stock between seasons of consumer demand. Simplification and standardization lie at the base of such a program.

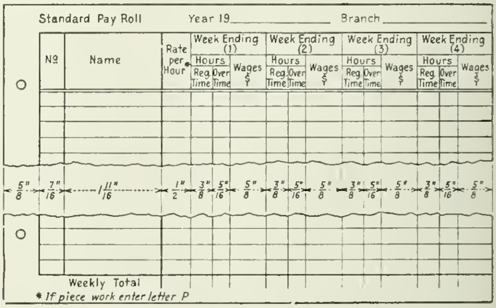
Scientific Methods of Management Are Necessary

Volume manufacture, predicated upon the bases just outlined, will not of itself necessarily produce large economies. It is here that the development of scientific methods of management steps in to make the program permanent and profitable—profitable in the sense that it will produce a surplus for the upbuilding of the business, and that it will produce economies which can be passed along to the consumer to build good-will for that business and insure the continuation of demand.

How great the opportunity is for better management of many plants engaged in clothing manufacture can be seen from some of the comparisons made in the evaluations of waste as published in the chapter on this business in "Waste in Industry".[1] The best plant examined in that survey was charged with a waste of 26.73 points out of 100, and the poorest with 83.6 points; in other words, the second plant was under a handicap of 56.87 points as contrasted with the first plant. In the rating of management alone, the best plant was charged with wasting 17.49 out of 77.2 points while the poorest plant was charged with wasting 60.45 points out of 73. This is not a very favorable record.

Simplification of Products

One of the first steps which scientific management will develop in men's clothing manufacture will unquestionably be the lessening of the number of models and cloths offered the trade by most members of the industry. Again turning to the chapter in "Waste in Industry," we can see how obvious is the necessity for attacking this condition. One manufacturer was found who was offering a choice of 278,000 variations. The survey also showed that one maker was getting 93 per cent of his business on 11 out of 44 models of sack suits; another was getting 85 per cent of his sack suit business on 14 out of 31 models, and 89 per cent of his overcoat business on 14 out of 26 models; a third obtained 95 per cent of his sack suit business on 9 out of 22 models, and 94 per cent of his overcoat business on 8 out of 20 models; while a fourth plant under scientific management offered only two men's and six young men's models to obtain the bulk (84 per cent) of its business, and made only 16 per cent of irregular models. Two-thirds of its whole business was on three models in less than 300 cloths, and this enabled the company to manufacture for stock during the dull seasons, evening its curve of production and making its product in large lots.



Standard Pay Roll Year 19________ Branch________

Nº	Name	Rate per Hour*	Week Ending (1)			Week Ending (2)			Week Ending (3)			Week Ending (4)		
			Hours		Wages $	Hours		Wages $	Hours		Wages $	Hours		Wages $
			Reg. Time	Over Time		Reg. Time	Over Time		Reg. Time	Over Time		Reg. Time	Over Time	
	Weekly Total													

* If piece work enter letter P

FIG. 1 STANDARD 8½ x 11 IN. FORM FOR PAYROLL

This problem is attacked properly by analyzing past sales, not merely to ascertain amounts and percentages but also to establish by statistical methods the trends of each model. Market research by a staff man and reports by salesmen can be used to keep watch of the efforts of competitors to establish new models. Simplification will not necessarily mean the abandonment of the creative work of the designing staff, but scientific methods in marketing will demand a restricted sales test before a new model is definitely added to the regular line.

With his line standardized, the manufacturer is ready to tackle the problem of seasonal production, bearing in mind, of course, that the ultimate consumer demand must be seasonal. With charts showing the trend lines of models by cloths, he can, in many cases, with reasonable safety, select a considerably varied list of those in which the trend line shows no marked decline, and proceed to make these for stock during the dull period, keeping his normal crew employed and clearing the decks for the rush of other models in the busy season. It is, of course, essential that he keep in close touch with his market and with the textile trade in order to check the apparent trends in those fields against his program of forward production. He has a large factor of safety in the greatly decreased cost that accompanies such a plan of production and in the holding together of his working force.

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[1] Section on "Men's Ready-Made Clothing," by Morris L. Cooke.

This plan calls for an intensification of sales effort. He must establish standardization to the greatest possible degree in quality, delivery service, and prices. This does not mean that the prices must not change; it does mean that they should not change except as they follow the general trend of the industry. Statistical research will help to forecast price changes, as well as style and consumption changes, and with his ability to plan his purchases well in advance and to come into the market in the dull season for his fabrics, he may put himself in that enviable position where he can lag on rising selling prices and precede on dropping selling prices. This will be particularly true on his staples.

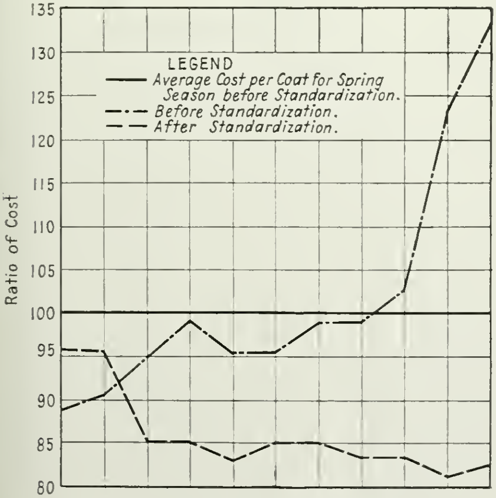

FIG. 2 COST REDUCTIONS BY STANDARDIZATION

He must fight for the greatest possible control of his market. This may mean that he should establish a brand for his product so that the consumer can identify it. This brand must be established by skilful advertising and energetic merchandising. His financial position will dictate whether he must do this by intensive selling effort in favorable sections of the country or extensively over the whole country.

Market analysis will enable him to set up a standard valuation of the sales he should secure from each of his sales territories against which he can set up sales quotas for each of his salesmen, taking into account the capacity of each salesman and the development of the salesman's territory as shown by past sales records. These quotas are the foundation upon which all his plans must rest, including purchasing, production, and finance. Utilizing what scientific method has so far developed, he can then establish better control over his selling work by studying proper frequency of calls upon towns and customers, and routing his men to obtain the largest volume of business at the lowest cost. This brief outline is only a hint of the steps which he can take to overcome the vexing problem of seasonal oscillation of production.

Effective Production

With the larger matters of policy out of the way, the manufacturer in this industry is still facing the problem of getting control of his production. Except in a few plants, production is characterized by alternating times of congestion and lack of work at key operations.

It will usually be found that little attention has been paid to the standardization of the equipment of the plant. Various types of machines are often used for the same operation. Study of the proper speeds of machines has not been made and uniformity of speed in batteries of machines on the same work has not been sought. Maintenance inspection of machines is usually lacking, and operators frequently have to wait until a repair man can get to them. No special attention has been paid to the stock of spare parts or spare machines.

A frequent cause of waste in production is the actual loss of materials through faulty control and the waste in production time due to the lack of materials and supplies when needed. There can be no proper control of production unless it is preceded by an adequate control of materials. Methods of material control are highly developed and are applicable to the garment industry with only minor modifications. Classification of stores, good physical storage conditions, and proper stores records form the second step in securing control of production and purchasing.

Job Analysis and Time Study

Before any real production control can be attempted, it is essential that each operation be studied, perfected, and standardized. The word "real" is inserted above because so many attempts at production control have wholly or partially failed when attempted without the standardization of working conditions. The two things can progress together but it is essential that at least the key operations be made right before planning will be sufficiently accurate to give real control. Job analysis and time study bring about these results among others: Developing best methods which are made standards; setting of standard times of performance; analyzing of shop capacity and balance of equipment; and setting of fair wage rates and wage incentives. (See Fig. 1 for standard payroll form).

Production Planning and Control. In a broad way, planning covers the procurement, storage, and issuance of materials, the methods and sequence of operations, the routing of work, and the balancing of the work of departments and work units. In the clothing industry, since production is by lots and not by continuous processes, planning is especially effective in reducing wastes of time and materials. (See Fig. 2).

A Specific Example

Scientific management in one of the most advanced plants in the garment industry has produced worthwhile results.[2] A master plan on this basis brings about the following advantages: it saves in cost of manufacture; reduces work in process; requires less manufacturing space; and establishes conditions such that production planning and control are effective. In formulating such a master plan these facts are given consideration: How many units, what kinds, and for what dates of delivery can the factory produce; how many units, what kinds, at what dates, and at what prices can the sales department sell; how much business can be financed and for what period?

The vital part of the master plan is the forecasting of sales and the making of the sales estimate upon which all other plans must be based. The estimate will not be of value unless it is lived up to, and this requires a definite sales control. In order to establish sales control there must first be a simplification and standardization of the line of products.

A master schedule is drawn up which shows the number of styles, quantity of each style, kinds and quantities of raw material for each style, price of each style in each material, and quantities at each price, estimates of cost of manufacture of each style and income from sales, and dates when goods are to be ready for manufacture and for delivery. From the master schedule, purchasing tasks and production orders are originated. The purchase tasks are the instructions and schedules for purchasing and the manufacturing orders are the instructions for the factory. In both, the establishment of the sequence of lots is important. These assignments are approved in conference by the heads of sales, production, and purchasing departments.

The purchase of some of the more important materials, decisions concerning which must sometimes be made months in advance, is confirmed in conference by the general manager and the managers of sales and production. Many of the other materials can be purchased on requisitions originated from the balance of stores records upon the basis of maximum and minimum quantities. A complete set of purchasing records is maintained, one interesting example of which is the "material number task record" which shows to which purchase task the material received is applied.

Material control is maintained by the methods that have been developed by scientific management for many industries. The balance of stores record is kept by the planning department and stores issues are originated by them. Piece tags on yardage goods and bin tags on other supplies are in use, and the physical inventory is consistently checked with the balance of stores records. All unused materials are returned with a copy of the stores issue to the storeskeeper. In this industry a salvage section of stores is important in order to dispose of unused material before the season or style passes.

The planning department has these sections—scheduling, dispatching, routing, operation analysis, instruction, and balance of stores.

Manufacturing orders, after checking to make sure that patterns and materials are available, go to the scheduling section. This section schedules the work to departments to balance production and to meet delivery dates, establishes the order of work by departments and schedules times for each department on each lot, plans to make the longest possible runs of the same character of work in each department, and plans to keep certain groups of operators on one model rather than to rotate models. In connection with this last feature simplification of the line is important in order to obtain the necessary volume on any one model.

SHAPE BASTING IN SACK COATS
"A" Grade. Peak Lapels
Tweeds, Serges, and Worsteds.

Hand Operation

Sy.	Elements	Time per stitch, min.	No. stit-ches	Stitching time, min.	Handling time, min.	Delays
a	Get coat and trim notches of both lapels				0.73	
b	Turn coat inside out				0.20	
c	Shape whole collar and lapels				1.74	
d	Baste top of collar from lapel to lapel	0.032	98	3.12		
e	Baste left side near notch	0.057	6	0.34		
f	Baste right side near notch	0.034	8	0.27		
g	Baste along collar (under)	0.032	24	0.78		
h	Look over and lay aside				0.11	
	Total		136	4.51	2.78	

Total time for cycle..........7.29

NECESSARY DELAYS
Thread needle..........3.4%
Rest..................10.0%
13.4%

7.29 + 0.134 (7.29) = 8.27 min. per coat
7.2 coats per hr.
57.6 coats per 8 hr.

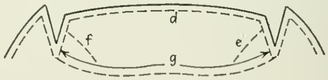

FIG. 3 PRODUCTION STANDARDS FOR COATS WITH PEAK LAPELS

The dispatching section assigns jobs by regular schedule. A maximum and minimum load is established for each important operation. A progress of work sheet is also maintained. There may be one central dispatching station or the work may be decentralized into departmental dispatching stations.

The route clerk prepares route sheets to establish the sequence of operations. He also defines the work of each operation, establishing standard methods by which each operation shall be performed. His work furnishes the basis for job tickets and instruction sheets.

An important part of the work of the planning department is determining how fabrics shall be cut. These plans specify the length and width of each piece, the amount of yardage that any combination of sizes will require, the best combination of sizes to reduce the amount of material used and the cutting time, and include written instruction for the job.

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[2] See *Industrial Management*, May-August 1919, "Factory Management in Garment Trades," by Mack Gordon. Installation made by The Thompson and Lichtner Company.

Some other points emphasized are: The necessity of establishing right conditions by adequate preparation of work and equipment, the proper planning of the flow of work, and the establishment of a rigid inspection; the use of job analysis and time study as a means for improving methods and equipment and the establishment of standards for methods, wages, and incentives; and the importance of incentives on work requiring judgment to prevent waste of materials or time.

Development of Management in Small Plants

To summarize the essential features of development for small plants (general principles apply also to larger ones) the following quotations are taken from a professional report [3] prepared for a Garment Manufacturers' Association and a Garment Workers' Union, in ladies' skirt manufacturing, in joint agreement. The report is noteworthy as being one of the earlier of garment management analyses for co-operative action.

SHAPE BASTING IN SACK COATS
"A" Grade. Square Lapels
Tweeds, Serges, and Worsteds

Hand Operation

Sy.	Elements	Time per stitch, min.	No. stitches	Stitching time, min.	Handling time, min.	Delays
a	Get coat and trim notches of both lapels				0.60	
b	Turn coat inside out				0.20	
c	Shape whole collar and lapels				1.60	
d	Baste top of collar from lapel to lapel	0.032	84	2.69		
e	Baste left side near notch	0.047	6	0.28		
f	Baste right side near notch	0.034	7	0.24		
g	Baste along collar (under)	0.032	21	0.67		
h	Look over and lay aside				0.11	
	Total		118	3.88	2.51	

Total time for cycle........6.39

NECESSARY DELAYS

Get lot	0.8%
Get ready	1.1%
Thread needle	4.1%
Rest	10.1%
	16.0%

6.39 + 0.16(6.39) = 7.41 min. per coat.
8.1 Coats per hr.
64.8 coats per 8 hr.

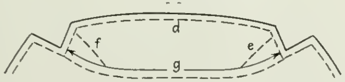

FIG. 4 PRODUCTION STANDARDS FOR COATS WITH SQUARE LAPELS

MANAGEMENT

The science of management involves not merely the handling of the shop, that is, the manufacturing division, but (1) the organization of the financial division; (2) the organization of the sales division; (3) the organization of the shop.

Financial Management. In the financial end of the business is involved the handling of the problems of financing, requisite surplus, payments of dividends, and depreciation in plant, as well as the more detailed process of cost accounting. A sound policy in these financial problems and well-defined means for determining for private use the individual costs of production are involved in the success of the concern and its ability to pay wages.

Sales Management. The sales problem also is of the utmost importance in the conduct of the business. In many lines of manufacture, manufacturing costs are appreciably reduced by thorough co-operation between sales and production departments for the purpose of developing most profitable lines, pushing the sale of certain styles, and doing all that is practicable to study and regularize this end of the business.

Manufacturers, especially acting as a group, with the aid of the worker, who is so vitally interested from the standpoint of regular employment, also can exert a certain influence on the steadying of production and reducing of the seasonal fluctuations.

Shop Management. The problem of shop management, as we find it in the garment industry, resolves itself into two distinct fields.

1. The development of the standard efficient shop.
2. The development of standards for the setting of rates or the fixing of wages.

The first of these, that is, the organization of the shop, naturally involves and includes the second, because a shop cannot be truly efficient unless and until the method of paying the employees is standardized to eliminate so far as possible the variables due to working conditions, changes in style of garments, and mere judgment. Remuneration, to be fair, must allow for such variations as are bound to occur in practice and must be governed by the output of the individual worker.

In this report it is proposed to treat both the development of standard methods and the development of standard rates.

ADVANTAGES OF STANDARDIZATION

In the sections which follow are taken up in detail the results that may be expected with the introduction of standard methods. To the manufacturer this means lower cost of operation through the elimination of delays, saving in materials, and increase in output. To the worker it means the adoption of the easiest methods of performing the various operations, the elimination of waiting for work, greater uniformity in wages, and more just reward for ability. The most important result to both the manufacturer and the worker is the determination of facts and the establishment of uniform methods which tend toward the elimination of friction.

For a single small shop, taken by itself, the expense of the necessary studies for the establishment of standard methods would be prohibitive. If considered as one of a number of shops, however, the benefits would be as great proportionally as for the larger shops, because all would receive the benefit of the studies made and the methods suggested would be especially applicable to each individual type of shop.

DEVELOPMENT OF THE STANDARD EFFICIENT SHOP

Examination into the operation of any industry brings out at once the differences in methods of management in the various shops. These differences are particularly noticeable in:

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[3] Report compiled by The Thompson and Lichtner Company in 1916.

1. Method of distribution of work to employees.
2. Evenness of flow of work.
3. Condition of work as it goes to the employees.
4. Speeds of machines.
5. Methods of operating the machines and performing hand operations.
6. Upkeep and repairs of machines, belts and implements.
7. Economy in use of materials.
8. Working conditions such as light, ventilation, accident hazard, cleanliness, etc.

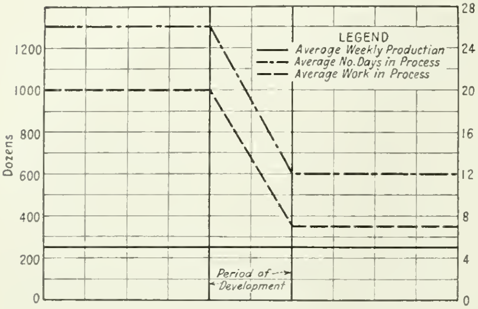

FIG. 5 STANDARDIZATION SAVES IN TIME AND INVENTORY

Poor conditions in any one of these lines will result in appreciably increased cost to the manufacturer and reduced earnings to the employee. To bring this out still more clearly, we may consider these points briefly:

1. The distribution of work involves the method in which the work is given out to the employee, the size of the lot, the manner of handling, and the means of keeping track of the garments.
2. The evenness of flow is also a feature of the distribution. The questions arise as to whether the different branches are balanced to avoid waits, whether the variations in time on different styles are provided for, and whether the employee has to wait between lots.
3. The condition of the work as it comes to the employee is another feature of the distribution. If the various employees in the branches next preceding the one considered do not treat the garment in the same way; if faults due to previous branches require correction; if the condition of the garment necessitates preliminary work in getting ready, the amount of labor per garment may be greatly increased.
4. Variation in speeds of machines may produce appreciable variation in output and irregularity of earnings. This variation may occur in the same machine at different times, in different but similar machines in the same shop, or in similar machines in different shops.
5. The methods of operating machines and performing hand operations require definite standardizing. There is a proper way of handling any machine or process. One of the causes of variation in both quantity and quality of work turned out by two different employees is the difference in method of doing the work.
6. The repairs and upkeep of machinery in any industry affect, to a large degree, the cost of the work and the amount and quality of work done. If shutdowns occur, if belts slip, if the machines do not operate smoothly, annoying and aggravating delays occur, and frequently faulty work is produced which is not due to the lack of skill of the worker.
7. In the ordering of materials, and in the cutting, the surplus and the waste affect the profits to a large degree. Improvements can be made by the establishment of accurate methods of cutting to reduce waste to a minimum.
8. The effect of working conditions is more intricate, but none the less important. This is no longer a matter of theory, but the results both to the manufacturer and the employee have been so marked through developments in this direction that their value is unquestioned.

The report further contains a discussion of the method of handling a development, shops to select for the investigation and a detailed discussion of the principles of standardization.

The principles just discussed for women's skirt manufacture were applied on the Montreal men's clothing work previously mentioned, where the development was carried on by the manufacturer but with the co-operation of the union. The friction which is normally incident to garment work was eliminated and the cost of coatmaking as shown by diagram was reduced about 15 per cent. This was a noteworthy reduction especially when it is remembered that no direct incentives were introduced. (See Fig. 2).

An illustration of the method of determining production standards is illustrated in Figs. 3 and 4. Note the manner in which similar unit times may be used in different operations, and also the necessity, even in very similar operations, for distinguishing the variables and setting separate standards.

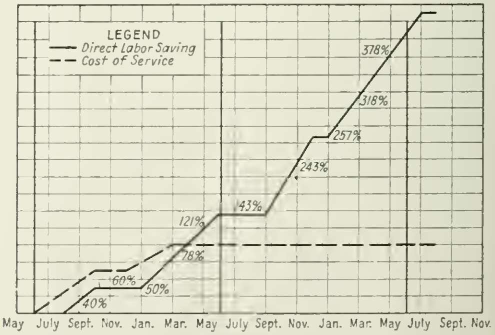

FIG. 6 RATIO OF SAVINGS TO COST OF STANDARDIZATION

The similarity in principle of all needle work is recognized and the results are effective in both general and specific ways. The adoption of scientific methods of management in a Mid-Western plant making leather coats and cotton and woolen shirts reduced the days in process from 26 to 12 (and later to 9), while the average quantity of work in process was reduced to one-third of its former value. (See Fig. 5). The average weekly production, on the other hand, was maintained uniform.

Standardization costs money, but the savings far outweigh the expense, as the case of one clothing factory, charted in Fig. 6, shows.[4] Within six months after this installation of standardization work savings equaled the added expense and continued to increase thereafter, while the expense remained constant.

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[4] From the practice of Thompson and Lichtner Company.

Applications of Motion Study

Its Use in Developing the Best Methods of Work

By FRANK B. GILBRETH and L. M. GILBRETH

Consulting Engineers

THE previous article[1] has explained the development of a classification of the elements of work into subdivisions of cycles of motions called therbligs.

To make these 17 therbligs more real, tangible, and easier to visualize and remember, different colors are used to distinguish them on the simultaneous motion cycle chart.[2] One member of our organization, Paul M. Vanderhorst, who conceived the idea of adding *plan* to our list of therbligs also suggested the idea of showing the 17 therbligs in the design of a wheel, and we have adopted a "Wheel of Motion" not altogether unlike the "Wheel of Life" of Hindus, for explaining therblig study to the employees of our clients. Each part of the wheel representing a therblig has its own individual color, and each of the colors has a special meaning and is also mnemonic. See Figs. 1 and 2.

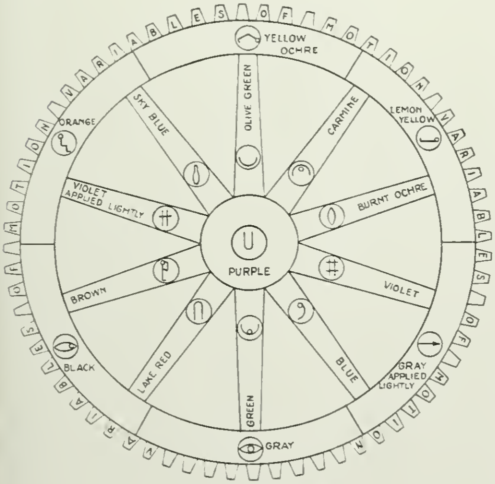

FIG. 1 THE WHEEL OF MOTION

It should be noted that *use* is the hub of the wheel. *Use* is the most important therblig. The more *use*, the more production.

The therbligs that have like characteristics, although they may represent reversed action, are shown as paired spokes on opposite sides of the wheel.

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The rim of the wheel consists of two different kinds, or orders, of three parts each, and the cogs on the rim are shaped like the letter V, and are to remind the motion-study student that the variables affect all of the therbligs and must be all carefully considered in order to obtain The One Best Way to Do Work. There are at least a hundred variables that are important on nearly all kinds of work and our complete list contains several thousand variables. It is extremely important to recognize that information relating to the variables is applicable to all kinds of work. The application of this information is simply a matter of degree required in the particular study in hand.

The same colors are always used on the same therbligs wherever they are represented or shown. This permits instant visualization of all the therbligs of any one kind. These colors are specially important in connection with quickly visualizing, grouping, comparing, and interpreting the behavior and happenings on simultaneous motion cycle charts. The use of the standard colors enables the micromotion study engineer to acquire a proper sense of the proper time for each therblig, even before a new study is made. This is particularly important when studying an operator for his first time, as it will show whether or not he is fully co-operating.

In fact, too much stress can hardly be laid on the importance of showing each and every therblig and all possible happenings on the simultaneous motion cycle chart in finding The One Best Way to Do Work. We know of no other method in finding The One Best Way to Do Work. It answers all purposes satisfactorily.

After sufficient experience and study, preferably in a motion-study laboratory, the interrelations, peculiarities, and suitabilities of the therbligs on several simultaneous motion cycle charts of different kinds of work will be recognized by an engineer trained in motion study. When he has the proper training he is invariably able to improve and completely revolutionize any work on which the micromotion study method of attack has not already been used.

Relation of Therblig Study to Stop-Watch Time Study

The symbols here shown furnish a sort of shorthand which makes for greater speed in making notes regarding best sequences of therbligs and motion study in general, and for remembering the therbligs easily. The results of careful study of the peculiarities of the therbligs individually, and in combination with those that immediately precede and immediately follow, as well as those that are executed simultaneously by other anatomical members, will remove for all time any idea that scientific motion study of the behavior of the workers can be accomplished with any such obsolete device as a stop-watch, or that time study and motion study are the same thing or even similar.

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[1] A preceding article, "Classifying the Elements of Work," has appeared in MANAGEMENT AND ADMINISTRATION for August 1924, p. 151.

[2] See "Applied Motion Study," by Frank B. Gilbreth and L. M. Gilbreth, page 138.

The literature of scientific management is full of examples where time study and motion study are confused. This confusion abounds even in books that are considered classics. It should be recognized that "Time study is the art of finding how long it takes to do work". This was Taylor's original definition, and it is still good. Time study is the great invention of Dr. Taylor. Taylor never did any motion study [3] of any kind whatever.[4]

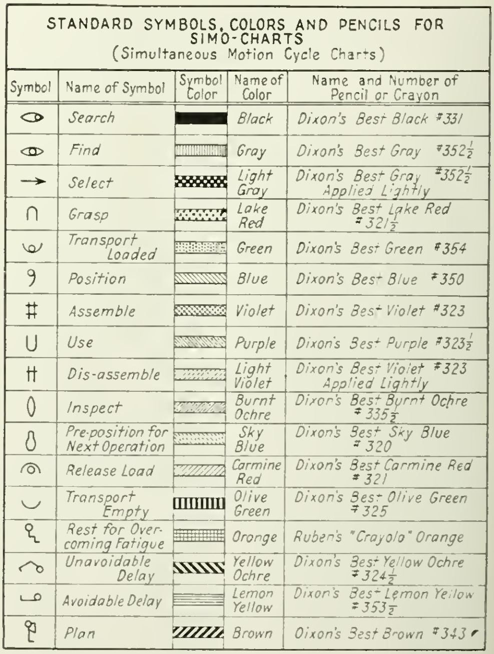
The definition of motion study is: "Motion study is the science of finding The One Best Way to Do Work". Of course micromotion study gives records in indisputable permanent form of the motions and behavior of the demonstrator of the methods and of the individual errorless times of each therblig of each cycle of motions and of the over-all times of the operator.

Transferable Data

Intensive study of the resulting therbligs furnishes information that is interchangeable in all kinds of work for finding The One Best Way to Do Work. It is this feature of the great value of the interchangeability of the indisputable detailed data that makes it most desirable to select as demonstrator of a method that person only who is *the best demonstrator obtainable* of the best methods extant or the best known, and in a motion-study laboratory [5] equipped for the purpose, and under controlled conditions.

It is obvious that records of the methods of recognized champions are most desirable. It must be recognized, however, that champions are usually champions because others are so inefficient. The synthesis of the best components of the methods of two or more champions will make a method better than that of the method of the champion of champions and better than the method of *the one best demonstrator obtainable*.

Data regarding the therbligs of a champion or a super-expert in any one kind of work are usable on a great many different kinds of work, for the times and skill on each therblig are transferable. It is also desirable, but not absolutely necessary, that *the best demonstrator obtainable*, of the best method extant, shall have sufficient experience to perform the cycles of motions and the complete operation in the shortest time for that operation. However, it is often difficult to obtain anyone who can demonstrate the combination of the *best method known* and also the *best speed of performance*. Oftentimes the expert of motion study can demonstrate the sequence of therbligs which constitute The One Best Way to Do Work, yet, because of his lack of practice and speed, is not able at first to equal the times nor the relativity of simultaneity of therbligs performed by different anatomical members of those with a much poorer method, but with much greater natural dexterity, who have had so much practice that they have arrived at a state of motion automaticity.



STANDARD SYMBOLS, COLORS AND PENCILS FOR SIMO-CHARTS
(Simultaneous Motion Cycle Charts)

Symbol	Name of Symbol	Symbol Color	Name of Color	Name and Number of Pencil or Crayon
👁	Search	■	Black	Dixon's Best Black #331
⦿	Find	▥	Gray	Dixon's Best Gray #352½
→	Select	▩	Light Gray	Dixon's Best Gray #352½ Applied Lightly
∩	Grasp	▩	Lake Red	Dixon's Best Lake Red #321½
⌣	Transport Loaded	▦	Green	Dixon's Best Green #354
9	Position	▧	Blue	Dixon's Best Blue #350
#	Assemble	▩	Violet	Dixon's Best Violet #323
U	Use	▧	Purple	Dixon's Best Purple #323½
⧺	Dis-assemble	▨	Light Violet	Dixon's Best Violet #323 Applied Lightly
0	Inspect	▨	Burnt Ochre	Dixon's Best Burnt Ochre #335½
8	Pre-position for Next Operation	▤	Sky Blue	Dixon's Best Sky Blue #320
⍥	Release Load	▨	Carmine Red	Dixon's Best Carmine Red #321
◡	Transport Empty	▥	Olive Green	Dixon's Best Olive Green #325
ϱ	Rest for Overcoming Fatigue	▦	Orange	Ruben's "Crayola" Orange
⌒o	Unavoidable Delay	▧	Yellow Ochre	Dixon's Best Yellow Ochre #324½
⌞o	Avoidable Delay	▤	Lemon Yellow	Dixon's Best Lemon Yellow #353½
♇	Plan	▨	Brown	Dixon's Best Brown #343

FIG. 2 SYMBOLS, COLORS, AND PENCILS FOR SIMO-CHARTS
In practice, column 3 is solid colors, not crosshatching.

It is here that the method of recording lateness of therbligs previously cited is of importance. Here again the detailed records of the therbligs are of great value, for the correct times of individual therbligs and the proper relativity of simultaneity can be obtained even from inferior sequences where great dexterity and automaticity have been recorded under the wrong method. When the best sequence is known, the correct time for task management for performing The One Best Way to Do Work *can be prophesied before anyone can demonstrate it.* The importance of prophesying the time for accomplishing The One Best Way to Do Work before it can be demonstrated will be appreciated when it is realized that there is not a single case on record where The One Best Way to Do Work has been derived by the wasteful fumbling methods of evolution.

Relation of This Classification to Fatigue Study

Much has been written in generalities regarding unnecessary fatigue. Because of the dreadful working conditions in nearly all factories, some improvements can almost always be made by anyone with good intentions and authority together with sufficient continuity of purpose. However, such improvements are only part of what could be done and often lapse after the passing of the régime of the untrained enthusiast who is merely interested in the elimination of unnecessary fatigue. The One Best Way to Do Work is that sequence of therbligs which permits the work to be done in least time, with least fatigue, and entails having the periods of *unavoidable delay* (therblig *o*) and *avoidable delay* (therblig *p*) utilized for *rest for overcoming fatigue* (therblig *n*).

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[3] See Bulletin of The Taylor Society, June 1921.

[4] This can easily be proved by reading Taylor's own writings, and it is also a matter of record in our own office. This fact is entirely missed, perhaps unintentionally, by Taylor's biographer, Copley.

[5] Laboratory motion study has been criticized as being done under conditions that are different from actual conditions of the shop. The conditions of the shop should be changed until they duplicate the most desirable conditions of the laboratory.

The data relating to therbligs that cause or eliminate unnecessary fatigue can be filed in orderly fashion for future use under the classification shown herein.

Unnecessary fatigue should be recognized as the badge of ignorance of the therbligs and consequently of motion study. To eliminate unnecessary fatigue, there must be complete recognition that the therbligs are the fundamental elements of The One Best Way to Do Work, and are units for the application of the laws of motion study and fatigue study.

Relation to Standardization

Much has been written also of standardization, and The One Best Way to make standards is to proceed from the standpoint that the best standard is the one that best complies with the laws of motion study. It is quite impossible to standardize a method for quickest achievement of the state of automaticity without recognition and standardization of the individual therbligs involved and their combinations and sequences.

Automaticity of the wrong method, so prevalent in highly repetitive vocations like those of the textile trades, is the shame and disgrace of industry today. However, it will be quite useless for executives and managers to talk standardizations of the correct sequences of the therbligs for The One Best Way to Do Work until they know from personal experience the possibilities of micromotion study, and set the example in their own duties. For this purpose the simplest device is the executive's cross-sectioned desk which serves as a permanent reminder, and if used properly will furnish a permanent proof. It permits doing all manual work with almost exactly the same motions every time. It soon becomes strikingly evident how much faster work can be accomplished when the motions are made over the same locations each and every time. The next step is the search for The One Best Way to Do Work.

Because of the rule-of-thumb methods used in the past for obtaining standards, almost anyone can make improvements in the present state of standardization encountered in all organizations. The usual standards obtained by rule-of-thumb methods will always be temporary and transitory. If standards are based upon the permanent records of indisputable knowledge of the ultimate components of the cycles obtained by the micromotion methods, they will be in shape for cumulative improvement without any additional study.

Comparatively few organizations have given proper attention to the possibilities of standardization built upon indisputable measured elements, and but few standards have been made with due regard to the extra outputs in the savings of time and fatigue that result if the standards are made to conform with the laws of automaticity, which is the greatest free asset of the working man, whatever his occupation.

Relation to the Learning Process

For greatest speed with least effort and fatigue in learning, The One Best Sequence of therbligs should be used whenever possible from the very beginning of the learning period so that automaticity may be achieved in the shortest possible learning period and with least habit interference. The study of the 17 therbligs of this classification furnishes a means to shorten the period required to learn any kind of art, trade, profession, or other activity. Hence, there will be more time available to learn more jobs and thus gain promotion, and, by reason of more knowledge of the theory combined with the practice, prolong one's earning periods by teaching others, when one is too old to do a young man's total quantity of output.

Finally, the evils of deadening monotony do not exist where there is sufficient knowledge of the therbligs and the variables affecting them. As two cycles of motions can never be made exactly alike, the quest of perfection of methods is much more interesting and absorbing than the desire to know which part of the whole structure is the piece which is being worked upon, although the latter is supposed to be the millennium by the academic enemies of standardization.

Knowledge of measuring, selecting, and studying of therbligs makes all work fascinating, for while the best method known and performed under given conditions may be called for practical purposes "The One Best Way to Do Work," a still better method with new tools and new conditions is ever possible. There is no instance or example that cannot be improved with greater knowledge of the therbligs pertaining to that work. There are so many possible combinations of therbligs that the skilled worker with the knowledge of therbligs performing any work ordinarily considered monotonous has the opportunity to improve the temporary One Best Way to Do Work almost without limit.

It is not the fault of the skilled worker, if he has not been taught to visualize the therbligs, that he has not been given sufficient incentives to enlist and hold all of his zeal continuously, has not been taught the science that underlies his work, has not been induced to search for the scheme of perfection, has not been taught a filing method for his knowledge that he may have systematized improvement from his additional experience, and has not desired to teach the apprentices and other learners the best way that he knew.

The results derived under the method of attack that this classification embodies have been successful in every kind of work in which it has been used.

It is hoped that this description of this filing classification will be of service to those who are interested in efficiency, in making waste elimination attractive, and in finding and enforcing the managerial conditions which will permit The One Best Way to Do Work.

Test of Products for Research and Sales Promotion

IN order to determine the durability and wearing qualities of products which they manufacture, The Paraffine Companies, Inc., have developed many practical methods of testing. Among other means, they maintain a fence for testing paint, an exposure park for testing roofing material, and operate a special and novel device for testing linoleum, or Pabcolin.

The linoleum testing device subjects the floor covering to the same destructive wear that it would receive if actually placed on a floor under hard service. It consists of a revolving wood drum having a 12 ft. internal circumference. See Fig. 1. Samples of the floor covering 1 ft. in width are tacked to the inside of the drum, which is turned at the rate of 8 revolutions per min.

Large pebbles of Belgian flint, a quantity of coarse sand, and a flat piece of steel are placed inside the drum. These slide over the surface of the covering as the drum is revolved, and act on the linoleum with a pounding, grinding and cutting effect similar to the action of walking, the abrasion of grit, and the moving of sharp objects in actual service. By running the machine for a period of 14 hr. the pieces of floor covering receive a wear equivalent to that of from three to five years' hard use on an ordinary floor.

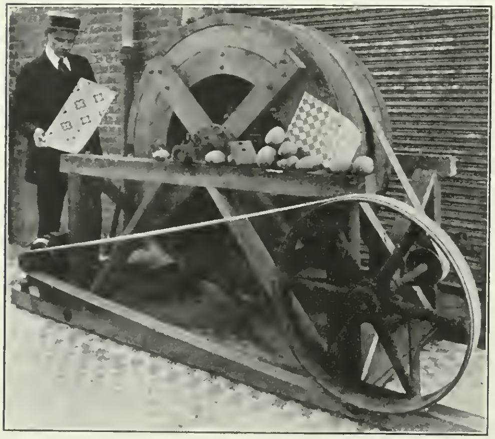

FIG. 1 DRUM FOR TESTING LINOLEUM

The company has also carried on a series of street tests with the linoleum (Pabcolin) which it manufactures. These tests were run in Los Angeles, San Francisco, Seattle, Portland and New York City. Strips of linoleum were placed in the street at busy corners where heavy vehicular traffic passed over them for 12 hr. In one test 17,000 wheels passed over one of the pieces used.

At the close of the day the pieces of linoleum were taken up, washed and examined in the presence of disinterested observers. It was found that the enamel coating was uninjured, and that no cracks or blemishes appeared on the surface. Scarcely any signs were evident of the severe use to which the strips had been put.

Index Number
66(072) Industrial products.
Testing

Other than the mere results were obtained from the experiments. The campaign moved a tremendous lot of Pabcolin, stimulated the dealer's sales, and because of the dramatic feature of the tests, created a great deal of interest in the product.

The test fence for paint, and the exposure park for testing roofing material are located at the company's plant in Oakland. The test fence is exposed to the sea fog, salt air, and other severe conditions prevailing in the San Francisco Bay region.

The fence consists of wooden slats between which the panels bearing the paint samples are placed. The panels are made of wood, glass and metal. Each panel is given a number which corresponds to a similar number in a record room. The record shows when the panels are placed in the fence, and their condition at various times.

Tests can be carried out here in about one-third the time required in the San Joaquin Valley, where another test fence is maintained, because of the severity of the exposure at the Oakland plant. The salt air and dampness are more injurious than even the very hot weather in the valley during the summer time.

By means of the test fences the company is able to advise its customers which paint is best suited to withstand certain climate conditions. Salesmen have absolute confidence in the product which they are selling, because they can back up their claims with actual demonstrations. Certain samples of paint can be made and exposed on the fence under conditions determined by the technical department of the company, and then sent out to salesmen for use in the field.

At the exposure park samples of roofing made by the company are exposed to the action of sun, wind, and rain, and their conditions are noted and recorded from time to time. Similar parks have also been established in other parts of the world, including Fresno, California, and India, for the purpose of studying the weather resisting qualities in different climates. In this way the company is able to advise customers which roofing is best suited to withstand conditions under which it must be used.

The company has also built a concrete tower for the purpose of testing concrete waterproofing material which they manufacture. The tower is built in five sections. Two of the sections are made of ordinary concrete untreated with waterproofing material; one section is made with ordinary cement mortar; one with cement mortar containing neutral Impervite (made by the company); and the fifth section is made with mortar containing white Impervite and white portland cement.

In making the tests the concrete tower is filled with water and observations are made of the imperviousness of the various sections. During the tests the untreated sections leaked continually, while the sections treated with the waterproofing material were leak proof.

Managing Maintenance Work With Economy

Methods of Taking Time Studies and Paying Bonuses

By THEODORE CLARK

Mechanical Superintendent, Eastern Manufacturing Company

THE general procedure for obtaining standard times and placing a crew on bonus has been as follows: With comparatively little preliminary planning or analysis "Mill" time studies (as opposed to "Theoretical" time studies) have been started and carried on for about three weeks.[1] During this period—which generally produces few, if any times of permanent value—a set of time-study symbols and an adequate method of working up time studies and filing results (generally different for each crew) are developed. The time-study man also has an opportunity to familiarize himself with the names of the tools used and to become at least slightly acquainted with the technique of the trade being studied. After this period, a most thorough survey of the proposition in hand is made, and also an attempt to lay out a general plan of the work which must be time studied to yield all the standard times necessary for placing the work on bonus. Then has followed a period of several months' duration in which as many "Mill" studies have been taken as possible. At the end of this period there has been another "stock taking," as it were, to determine, with the aid of the then not inconsiderable knowledge of the trade being studied which the time-study men have acquired, what parts of the work can well be strengthened by "Theoretical" time studies. These "Theoretical" studies frequently lead to discarding results and conclusions previously derived. From this it would appear desirable to start "Theoretical" time studies almost at once on starting to study a given crew. Experience has shown, however, that the lessons learned by several months' contact with the men and their work are too valuable to forego for the sake of possibly saving a month's time, and it is, therefore, only after several months that "Theoretical" studies are started.

Methods of Attack

It should, perhaps, be stated here that, in general, we have not attempted to teach the men their own trade. Thus, we have assumed that we could not improve on the average carpenter's use of a hammer or a saw, and we have left the development of better methods of the use of these tools to the men themselves, depending on the stimulus of bonus to insure efficient workmanship. An exception to this occurred in our machine shop, where we did specify standard speeds and feeds, the most economical selection of these being quite beyond the rule-of-thumb ability of any machinist on non-repetitive work on different materials of varying sizes.

Index Number
658.58 Maintenance and repair
658.5 Shop management

When the "Theoretical" studies have been completed, it has been found necessary to pick up "loose ends" by another month of "Mill" studies. We are then ready to draw up our tables of standard times and start the crew on bonus. The work described above as applied to a single crew—blacksmith's, for instance—has generally required two men with stenographic assistance, about eight months to complete. The standard times so obtained will allow handling from 80 to 90 per cent of the work of the crew. If two men have been studying the crew it has been our custom to let one of them teach the time-setters the technique of their work and smooth out the many little (if attended to, although fatal if neglected) grievances and misunderstandings which the first two weeks on bonus develop. The efforts of the other time-study man are devoted to strengthening classes of times which are weak, and to a close study and follow-up of the crews' earnings. After about a month the man teaching the time-setters is free to start work on another crew.

Tabulation of Times

The standard times, obtained as described above, are divided into three classes which we have named "Table" times, "Common Sense" times, and "Group" times. Table times comprise those times affected systematically by one or more variables (as for instance the thickness and width in cross-cut sawing spruce boards) and capable of being developed as a chart or table showing the effect of these variables. The tables or charts are generally typewritten and then blueprinted on paper with a suitable margin to allow binding. (See Fig. 11).

The term "Common Sense" times originated as a nickname to represent a record of a single observed time for such an operation as removing a 10 x 24 in. solid iron pulley from the end of a 2 15/16 in. shaft. Eventually, enough such "mongrel" operations will have been assembled to allow the preparation of tables to show the time required for such operations for sizes of pulleys or shafts other than those actually studied.

At the present time, we are still a long way from having the information necessary to do this. These times are filed on 3 x 5 in. cards in a visible index, with a description of the exact circumstances under which they were observed. Thus, for the millwright crew, about 800 of these "Common Sense" times have been accumulated. They are not regularly used, but they are at times very valuable. For instance, if the time for removing an 8 x 24 in. cast iron pulley from a

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[1] A previous article, of which this is a continuation, appeared in MANAGEMENT AND ADMINISTRATION for August 1924, p. 191.

2 15/16 in. shaft is required, a close approximation can readily be had from the 10 x 24 in. "Common Sense" card. It is surprising how close an estimate can be made of the time required to do almost any unusual operation by carefully using this catalog of times. Nevertheless, the use of these times is avoided whenever it is possible to do so, and "Table" times relied on which are unquestionably more accurate. When "Common Sense" times are used they are so marked on the instruction card as a signal to the workman that the time may not fit his job, so that he may check his work against the time allowed and claim a damage report, if necessary.

These remarks on "estimating" times must not convey the impression that the work of setting times for repair work is largely a matter of guess and estimate. It consists of careful analysis of the work into its elements and the synthesis of composite times from these elements by the use of the standard element times. There is not one job in ten in which reference must be made to the "Common Sense" time catalog and in this tenth case probably only one or two operations will be so derived.

The third type of standard times has been called "Group" times. These are largely used in construction work as short cuts. Several minutes are required to build up the time required to construct a wooden pier form from such elements as driving a nail and sawing a board. In order to avoid a repetition of this work whenever the time for building this particular form is required, a "group" card is made out showing the element operations and unit standard times which together make up the complete operation of building the form. This card, with complete notes of the exact conditions of the work, is filed for reference on future work. These times are very valuable and they become more so as time goes on and more and more are accumulated, especially on construction work where to construct a building from unit times would be quite an arduous undertaking.

Method of Setting Times

The method of setting times can best be described by reference to a specific instruction card.

The items and times on instruction card, Order No. P3 B11 678 No. 1, Fig. 6,[2] were arrived at in the following manner: A work ticket covering this particular millwright operation was passed by the routing stenographer to the time-setter. After reading the ticket, to get the location of the job, the time-setter went to the machine where the work was to be done. Determining the best method of procedure, the notes that he took were approximately as follows: To take off pinion, three bearing caps each secured with four cap bolts will have to be removed; position of bolt heads not readily accessible, making it difficult to work wrench. Fasten two chain hoists overhead to raise shaft out of bearing. To release drive shaft, drive face wheel ahead about six in. Remove old pinion and drive on new. To take gear off dryer head, remove guard fastened to machine by 12 cap screws and jack up dryer. Drive off gear. This practically completed the time-setter's inspection, and he returned to the office to write the instruction card.

The item, "Change ticket and read instructions," is incorporated in every instruction card as the first item, and the time used is one of our standard times. The next move, in the way of preparation for doing the work, was to get the tools and go to the job. The time for this was built up from three standard unit times: walk to toolroom 0.25; get tools 1.50; walk to job 1.25 (varies with location). The amount of time allowed for studying the job was determined, to a great extent, by the number and complexity of the different moves the workman would have to make during the *whole job*, and the approximate time he would spend in studying each separate move before going ahead. The next logical step in the way of preparation was the hanging of hoists. The times used for this operation are also standard times.

GROSS TIME TO MAKE GAIN IN HARDWOOD

Time in minutes

Surface Area	Depth of cut					Surface Area	Depth of cut				
	1"	1½"	2"	2½"	3"		1"	1½"	2"	2½"	3"
1" x 6"	2.35	3.25	4.15	5.05	6.95	2" x 6"	2.71	3.79	4.87	5.95	8.03
1" x 5"	2.05	2.80	3.55	4.30	5.05	2" x 5"	2.35	3.25	4.15	5.05	5.95
1" x 4"	1.75	2.35	2.95	3.55	4.15	2" x 4"	1.99	2.71	3.43	4.15	4.87
1" x 3"	1.45	1.86	2.35	2.80	3.25	2" x 3"	1.63	2.13	2.71	3.25	3.79
1" x 2"	1.15	1.45	1.75	2.05	2.35	2" x 2"	1.27	1.63	1.99	2.35	2.71

Surface Area	Depth of cut					Surface Area	Depth of cut				
	1"	1½"	2"	2½"	3"		1"	1½"	2"	2½"	3"
3" x 6"	3.07	4.33	5.59	6.85	9.11	4" x 6"	3.43	4.87	6.31	7.75	10.19
3" x 5"	2.65	3.70	4.75	5.80	6.85	4" x 5"	2.95	4.15	5.35	6.55	7.75
3" x 4"	2.23	3.07	3.91	4.75	5.59	4" x 4"	2.47	3.43	4.43	5.35	6.31
3" x 3"	1.81	2.40	3.07	3.70	4.33	4" x 3"	1.99	2.67	3.43	4.15	4.87
3" x 2"	1.39	1.81	2.23	2.65	3.07	4" x 2"	1.51	1.99	2.47	2.95	3.43

Surface Area	Depth of cut					Surface Area	Depth of cut				
	1"	1½"	2"	2½"	3"		1"	1½"	2"	2½"	3"
5" x 6"	3.79	5.41	7.03			6" x 6"	4.15	5.95			
5" x 5"	3.25	4.60	5.95	7.30		6" x 5"	3.55	5.05	6.55		
5" x 4"	2.71	3.79	4.87	5.95	7.03	6" x 4"	2.95	4.15	5.35	6.55	7.75
5" x 3"	2.17	2.94	3.79	4.60	5.41	6" x 3"	2.35	3.21	4.15	5.05	5.95
5" x 2"	1.63	2.17	2.71	3.25	3.79	6" x 2"	1.75	2.35	2.95	3.55	4.15

Note: Add .10 min. to get chisel in hand and remove.
The 2nd dimension is the width of the beam.
Time is gross including picking up and laying down saw, chisel, and hammer.
Time in above table does not include time for locating position of gain. Take measuring times from Table No. VIII.
Table of time is for a gain made under usual millwright conditions that is, smoothed down with chisel for a reasonably close fit. If conditions necessitate an exceptionally close fit add 25% to gross time. (This percentage is a preliminary time.)
Times are made up of Miter Sawing from Table #11 plus chiseling times at the rate of .06 min. per cu. inch. (See Curve #8).

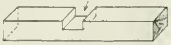

FIG. 11 CHART OF TABLE TIMES

Showing time allowed for operations affected by one or more variables.

Referring to his notes, the time-setter found that the next thing to do was to remove pinion and that, to do this, it was necessary to take out 12 cap bolts. He was allowed a time—1.04 each—which is a standard time for removing such bolts. In setting a time for removing four caps he used a standard time of 0.40 per cap. The item, "Drive face wheel ahead," was arrived at by referring to card having a Common Sense time of 19.20 for similar work. To move the shaft back, a standard time plus preparation was used. "Drive off old and drive on new pinion." As this type of work was similar to driving face wheel ahead the same times were used. The time for "remove guards" was built up from these standard units, remove 12 cap screws 12 x 1.36 = 16.32, release guard 1.08, place on floor 0.50. Throughout the whole instruction card the plan followed was the same as outlined above. This card is open to criticism in that the dryer gear was not moved to the job in advance, thus necessitating delay in getting a team to do this work.

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[2] See Management and Administration for August 1924, p. 194.

The method of getting information for instruction card Order No. U4 P11 500 No. 1 (Fig. 5)[3] was the same up to the point of the time-setter inspecting the job. In this particular case, the notes covered the facts that in order to remove the shaft, it was necessary to rig up two chain hoists, to remove a belt shipper held by eight bolts and a hood fastened by bolts to framework. In writing the instruction card, the same process of reasoning was followed as in the case cited above.

In setting times for the removal of the nuts and lifting off caps, two standard unit times were used, 0.48 for each nut and 0.40 for each cap. Standard times were again used for taking off the shipper, these being a combination of removal of nut times plus a heavy lifting time of 1.60 for lifting off shipper. The hood being fastened to frame with bolts, bolt times plus lifting and placing times gave the result of 5.46. Four standard units, hook on two straps at 0.50 each, raise with chain-fall 3 ft. at 0.30 per ft., swing out over truck 3.20, and lower $3\frac{1}{2}$ ft. 0.20 per ft., covered the whole operation "Lift out shaft".

The shaft was now in a position so workmen could remove the clutch. To do this they were allowed a time of 6 to drive off the hub, and of 9 to drive off the clutch, both times being obtained from cards of "Common Sense" times. The times allowed for hooking on with chain-falls and lowering with truck were standard times in both instances. The allowed times for taking to machine shop and tagging were arrived at from walking time to shop plus time for tagging work.

The amount of time including preliminary inspection, spent by the time-setter in writing these instructions ready to be typed, was approximately 30 min. for the first job and 10 min. for the second. Because of habitual use of the tables of standard times, in many cases instruction cards can be written from memory. The unit times used in arriving at the gross times, in both jobs, were more than 90 per cent standard times. The fact that these jobs were strictly nonrepetitive, the motions to execute them very complicated, and the final results of "Time Allowed" to "Time-Taken" so closely related, certainly justify the assertion that Standard Unit Times can be built up and applied to this class of work.

Type of Bonus

It was anticipated that the ratio of time allowed to time taken would vary greatly from job to job. That is, it was anticipated that the men would alternately badly "go behind" or badly "beat" our allowed times. It was decided, therefore, to adopt a sliding scale bonus with the amount of bonus earned determined by the week's performances rather than by the record of each individual job. A form was devised on which the job number, job title, time allowed and time taken for each and every job done by a man during the week could be recorded. At the end of the week, the "Time Allowed" and the "Time Taken" columns were totaled, and the latter divided by the former. When this ratio was equal to 1, that is, when the total time allowed on the different jobs just equaled the total time taken, a bonus amounting to 34 per cent of the man's weekly day wage was paid him.

Bonus Curve

If the total time taken was 40 per cent in excess of the time allowed, no bonus was paid; if the time taken was greater than the time allowed, but less than 40 per cent in excess of the time allowed, a proportionate bonus was paid. If the time taken was less than the time allowed, a proportionately increased bonus was paid, but at a slightly different rate, so that a 100 per cent bonus was earned when the time taken was one-half of the time allowed. This type of bonus was adopted to protect a man from losing all or a large amount of his bonus, if he "went behind" a little on his individual jobs or on his week's total, because it was felt that on repair work the uncertainty of the work made it unfair to employ the usual methods of bonus payment.

Owing to its characteristics, this arrangement was named "Merit" bonus. Actual practice has developed the fact that the men rarely go behind on jobs. The cause of this result has been twofold: first, a very keen desire on the part of the men to "beat" every job; and second, more accurate time-setting than was thought possible previously.

Results

No description of a scheme like the above is satisfactory or complete without a statement of the results it yields. This particular scheme not only works, but works well. The chief advantages are:

1. Quicker and cheaper execution of jobs.
2. Higher wages.
3. Better economy in slack times.

1. Work is unquestionably completed more expeditiously due to careful planning, procuring of materials, and "tying-in" operations. The work is also executed in a shorter time due to pick-up as a result of bonus. Thus a study of over 100 repetitive jobs done on day work and bonus over a period of two years showed a time taken of 7233.04 hr. on day work and 3331.21 hr. on bonus with a monetary saving (including allowance for all increase in overhead due to routing and bonus) of $1535.58 on this particular lot of jobs. It has also been found that the more careful preparation of jobs required to allow setting test times, necessitating as it does, physical inspection of the work to be done, has resulted in better planning.

2. The average earning on bonus jobs amounts to 43 per cent increase over day work. An average of 90

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[3] See MANAGEMENT AND ADMINISTRATION for August 1924, p. 193.

per cent of all work done is handled on bonus, so the net increase in wages amounts to 39 per cent. This high wage has placed the company in a very strong position in the local labor market. While it is a fact that the men feel they "earn every cent" of this high wage as a result of increased and more efficient effort on their part (resulting in the execution of jobs in somewhat less than one-half the time required on day work) it is also a fact that they get a pay envelope substantially fatter than those of neighboring concerns and, in the last analysis, this is what counts when more men are needed by this company or its competitors in the labor market. This company *has not lost a single man* of the mechanical department bonus crews since bonus started four years ago as a result of men leaving for "other employment" *where wages were a consideration.*

3. Generally routing and bonus schemes are criticized as being expensive during slack times. It is a fact that the "hourly rate" or total cost of work per hour is higher with a small crew than with a large. This is true with the usual "straight-line" organization although to a lesser degree. However, one unlooked-for saving of great importance has arisen during slack periods as a result of bonus. When work became slack under the day work scheme, this condition was sensed by the men, and the tendency on their part to "make the job last" was found to be a very hard thing to combat. With bonus, on the other hand, this condition is done away with, the men working full blast as long as the work holds out when the junior men in the crew are laid off or transferred.

In conclusion, it should be said that the success of this scheme has been due in a large degree to substituting a very real measure of loyal co-operation between the men on the job, their foremen, and the men in the planning department, for the sometimes-encountered straight-laced adherence to the exact functions as laid down in standing orders for the execution of the various parts of the work.

Conveyor Installation in a Fiber-Box Plant

THE applications of material handling equipment have become so universal that few plants are now without some form of mechanical device to take care of their lifting, transporting, and storing operations. It can be said in almost every case that a concern without equipment of this nature is not keeping pace with the times.

Conversely, the greater the amount of such apparatus employed in a plant the more up to date the firm usually is. It is possible, of course, to install a heterogenous collection of devices without regard to the work they are to perform, the hours of probable service, their relation to other labor-saving units with which they must operate, and their ability to stand up under hard service with a minimum of breakdowns and repairs. Apparatus which intelligent and careful investigation shows to be ill-suited to the work in hand should not be bought.

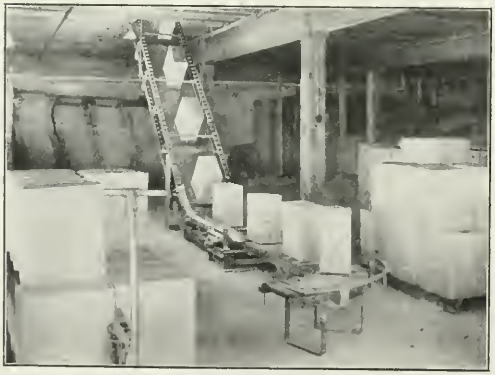

Fig. 1 Gravity and Chain Conveyor for Cases

But when a study proves the advantages of mechanical equipment over hand methods, nothing is gained by deferring to make the installation. Usually reductions in handling costs becomes apparent at once, and apparatus previously perhaps classed as a luxury becomes finally a necessity and a money-maker. Even the unusual cases where no cost reduction is in prospect, but only convenience is assured, probably in the end will show up as dollar-savers.

Index Number
628.281 Mechanical handling

The Traung Lithograph Company, manufacturers of corrugated shipping containers, have found it profitable to install handling mechanisms. In Fig. 1 are shown, at the right, cases delivered on a lift platform and ready for shipment. The handle of one of the lift-trucks is visible at the left of the illustration. In the center is located the conveyor which carries these cases from the basement to the floor above. The feed end of this conveyor is a gravity roller section which discharges to a chain and bar combination serving as an inclined lift.

When the cases reach the upper floor, as shown in Fig. 2, they are received by a gravity conveyor which carries them out through the window directly into the freight car for transportation to the consumer.

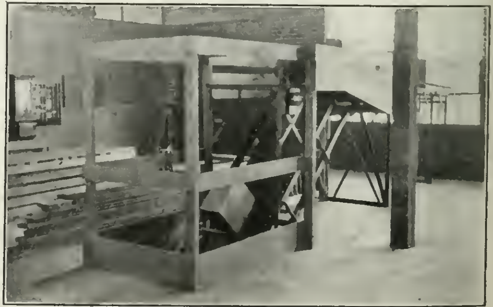

Fig. 2 Conveyor Takes Cases Through Window to Car

Progress Charts of the Vector Type

By F. J. SCHLINK

Mechanical Engineer

Index Number
658.532 Progress charts

THE necessity for finding a progress-of-work chart of a more flexible and widely useful nature than existing types. led to the development of one based on a new plan of recording, which offers certain advantages over previous types.[1] It has been found adaptable to a number of uses not hitherto conveniently met by progress-charting methods. For example, it has been employed for tracing the flights and return of carrier pigeons; for tracing 150,000 vouchers through the auditing routine of the Ordnance Department of the Army in closing up the contracts connected with war-time ordnance manufacture; in the military information services for following the course of military technical documents circulated to various service units; and at the Bureau of Standards for following the progress of important military and other testing work during the war and after.

The chart shows the bearing of three different related points upon each other (See Fig. 1): (*a*) the material to be examined or tested; (*b*) the stages of action which take place in connection with that material, and (*c*) the dates upon which the stages of action take place. The method of recording these three factors will be plain without special explanation by reference to the figure, which shows the simplest form of the chart. Note that each advance in the status of the work is indicated by one unit (45 deg.) of clockwise rotation of the record mark in the date square. The last column headed "S" (Summation) may be used, if desired, to record the total of actions, or the last action, to date.

This chart provides for a convenient and graphic means of recording promised or expected actions. For instance, if work is followed up before completion and a promise obtained as to the date on which any given stage of the work is to be completed, this is indicated by a dotted line in the corresponding date space, in the proper direction, as on October 8 in the example of Fig. 1. If the promise is met on the date assigned, a solid line is drawn over the dotted ones; if not, the dotted line remains as evidence of the promise, and a solid line is drawn in the date space for the day when the action was in fact carried out.

If it is decided that a given phase of the work should be followed up on a certain date, if not completed by that time, a circle may be drawn about the central dot in the square for that date. When the follow-up is actually carried out, the horizontal diameter of that circle is drawn. Note the example under October 7, of Fig. 1.

This type of chart offers an important advantage over any other that has been noted, in the matter of follow-up of delayed items. Each day, it is a simple matter to follow down the appropriate date column and pick up at a glance every item that is entered as needing follow-up that day. The chart is printed in light green to allow the entries to stand out without confusion.

The headings given on the specimen represent, of course, but one of a large number of possible applications of the method. For instance, it can be used for tracing important orders through the shop, special let-

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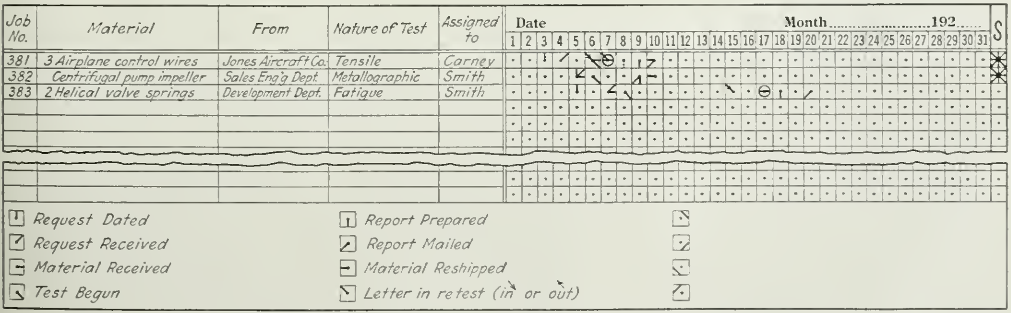
[1] The first design of this chart was described in the *Franklin Institute Journal*, May 1918. The present article describes new developments brought about by more extensive applications.



Job No.	Material	From	Nature of Test	Assigned to
381	3 Airplane control wires	Jones Aircraft Co.	Tensile	Carney
382	Centrifugal pump impeller	Sales Eng'g Dept.	Metallographic	Smith
383	2 Helical valve springs	Development Dept.	Fatigue	Smith

Date
Month .... 192....
1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31
S

Request Dated
Request Received
Material Received
Test Begun
Report Prepared
Report Mailed
Material Reshipped
Letter in retest (in or out)

FIG. 1 PROGRESS CHART AS USED FOR SCHEDULING TESTS AT THE BUREAU OF STANDARDS

The first entry refers to Test No. 381, to determine the tensile strength of 3 airplane control wires, as requested by the Jones Aircraft Company. The test was referred to Mr. Carney. The request was dated October 3, and was received October 4. On October 6 the material to be tested was received and on the same day the test was begun. The report of the test was prepared on October 9 and was mailed on the tenth, on which day, also, the material was reshipped. On the sixth a letter was received in regard to the test and on the seventh one went out. The arrowheads drawn on the lines indicate by their direction whether the correspondence is incoming or outgoing. The circle and its horizontal diameter on the seventh show the intention to follow up the work on that day and the carrying out of the follow up as planned.

ters or complaints through a correspondence or information department, estimates through the sales engineering department, and drawings through the drafting-room. The time scale may, of course, be changed to suit the needs of the work. For slow, long-drawn-out jobs the horizontal unit may be two days or a week, instead of one day; in other kinds of work one- or two-hour time units may be demanded.

Usually the number of symbols provided for in Fig. 2 will supply all minuteness of detail that will be needed in practice, but in the exceptional instance where more than 36 steps are necessary, a combination of a letter or number with the line symbol will provide all the entries for which there could be any possible use. The line symbol alone has an important advantage over the method of using a number or letter in the date square, in that the rotation of the vector lines, and their division into distinct groups or types, affords a mnemonic value to this type of symbol which the numeric or alphabetic does not possess, but more importantly the single line has a simplicity and legibility, within the given limits of space afforded by a small square, far greater than a letter or number. The straight lines of the 36 symbols are much more readily distinguishable among a complicated group than the multiple lines and curves of the arabic figures and letters of the alphabet.

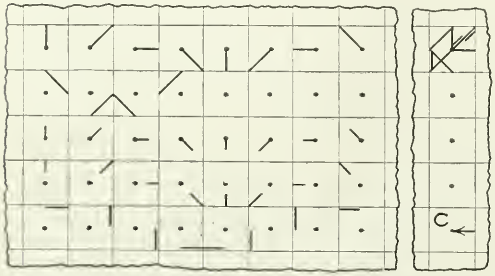


FIG. 2 SHOWS 36 EASILY DISTINGUISHED SYMBOLS

Note in example at upper right how the record remains perfectly legible even when 9 symbols appear in one square.

However, as suggested, in the very intricate cases where 36 separate symbols do not suffice, these symbols may be applied in combination with letters or numbers as suggested in the lower right-hand square of Fig. 2, where the letter "C" represents a primary or basic stage of action and the horizontal vector line represents a secondary stage perhaps common to several of the main stages. For instance, a letter "D" may refer to the preparation of drawings, and a line may be shown to represent an incoming letter regarding the drawings. A differently directed line may mean that the drawings were approved. Obviously, letters and approvals are items that may take place with respect to several of the basic or main stages typified by "D" (preparation of) drawings. Again, as to legibility, the elements shown in the lower right-hand corner of Fig. 2, a letter and a line, have a far better chance of being read under limiting conditions than have two letters, as a "D" and a "B" in the same square. In fact, the line symbol and the letter may be superposed, as is sometimes necessary, without much loss of legibility, but this is quite out of the question in the case of two or more letters or numbers together. The use of colors should be avoided.

There are some cases where the growing line method of progress charting has special and important advantages; for instance, in cases where it is important to obtain a quick and graphic picture of the status of a large group of jobs in relation to each other, and where minuteness of information is not so important as the obtaining of a quick idea as to the general status of each project. In such cases the vector method of presentation can conveniently be combined with the growing line, as in the example of Fig. 3. In this case, however, the follow-up will best be cared for by date-numbered tacks punched into the chart at the proper progress point on the line, as indicated in Fig. 3. This method of charting is used for tracing 150 standardization projects going forward under the auspices of the American Engineering Standards Committee, which it provides for in all desired detail, requiring very little clerical work per day.

The advantage of these types of progress charts are:

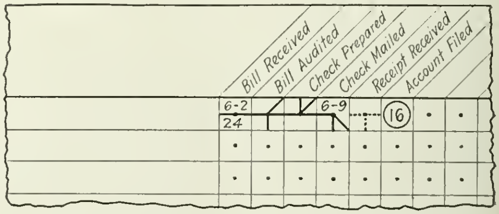


FIG. 3 COMBINATION OF VECTORS AND GROWING LINE

Dates may be written over the segments of the line as in the first and fourth squares. In the third square one vector line may signify, for example, that payment was by New York draft, and the other vector line, that a special letter of transmittal was dictated to go with the remittance. In the sixth square is shown a tack calling for follow-up on the sixteenth of the current month.

1. The whole history of the action on a given piece of work is recorded permanently.
2. Answers to inquiries received by mail or telephone can be given quickly and reliably by the central control office.
3. A large amount of detailed information regarding every important stage of the work can be recorded in exceedingly compact form and yet is readily interpreted whenever needed.
4. As compared with other familiar progress charts, this one has the advantage of showing the detailed process in attaining the condition shown.
5. The total interval required for the work is suggested at once in the chart of the type of Fig. 1 by the distance between the initial and final lines drawn, so that the rate of work of the several departmental organizations can be directly compared.[2]
6. By utilizing 2 lines, a predetermined schedule and its actual carrying out can be charted.
7. The charts have been found useful as comprehensive indexes to a large filing system, replacing ticklers, etc.

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[2] The type of chart shown in Fig. 1 can be obtained in a folded notebook size, $6\frac{3}{4}$ x 14 in., and in large sheets, 11 x 17 in.

Applying The Gantt Chart in France

Progress and Layout Charts Have Increased Output of Automobiles and Rifles

By SERGE HÉRANGER

Chief Engineer, Société Anonyme des Anciens Établissements Hotchkiss & Cie

Index Number
658.3 Gantt chart

AMONG the American pioneers in the scientific organization of work, the name of Gantt is one of the most honored in France. Gantt has always been considered in this country as representing a special factor in modern industrial methods—a factor which although closely connected with the Taylor concept of scientific management, still forms an original contribution to the improvement of industrial methods.

In later years, especially, the attention of the more progressive industrial circles in France has been called to the remarkable work accomplished by Gantt in the way of scientific control as illustrated by a special method of charting.

The attention of the Société Anonyme des Anciens Établissements Hotchkiss & Cie was called to this recent development of the Gantt Chart by a book written by Wallace Clark.[1] The Vice-President of the Société Hotchkiss, Laurence V. Benét, an American by birth and education, who has spent a great part of his life in France, was struck by the practical possibilities of the Gantt method of charting as set forth by Wallace Clark, and he decided to put this method into practice in the works of the company. He entrusted the task of installing the method to the writer of this article. The Gantt Chart has given the management of the Société an efficient means of controlling the progress of work, and has proved beyond question its value as an important factor in increased production.

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[1] "The Gantt Chart."

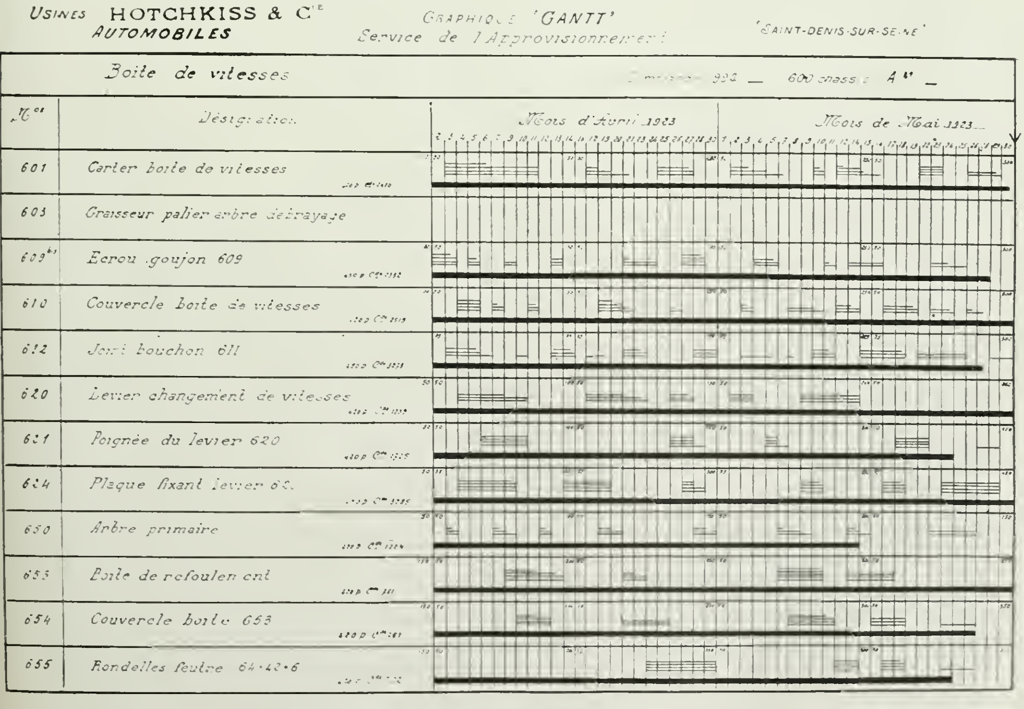


FIG. 1 STORES DEPARTMENT PROGRESS CHART

Required amounts are shown both for single and accumulated amounts, the fine lines indicating deliveries, the heavier lines the totals.

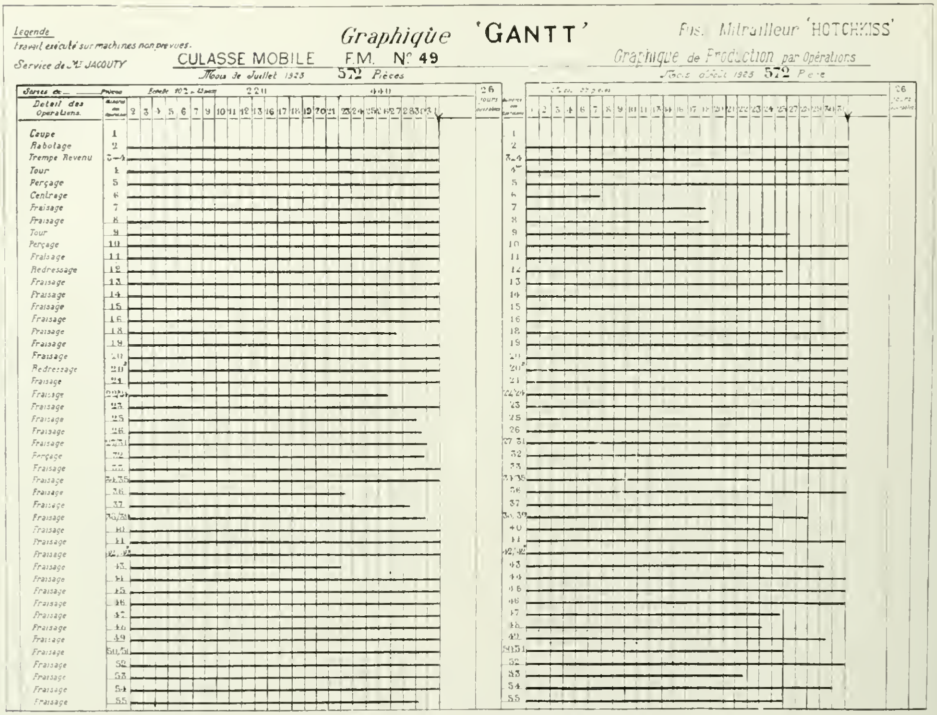


FIG. 2 MACHINE TOOL WORK LAYOUT CHART

Layout of the 55 consecutive operations for the breech block, the dotted line showing parts in stock before the chart was developed.

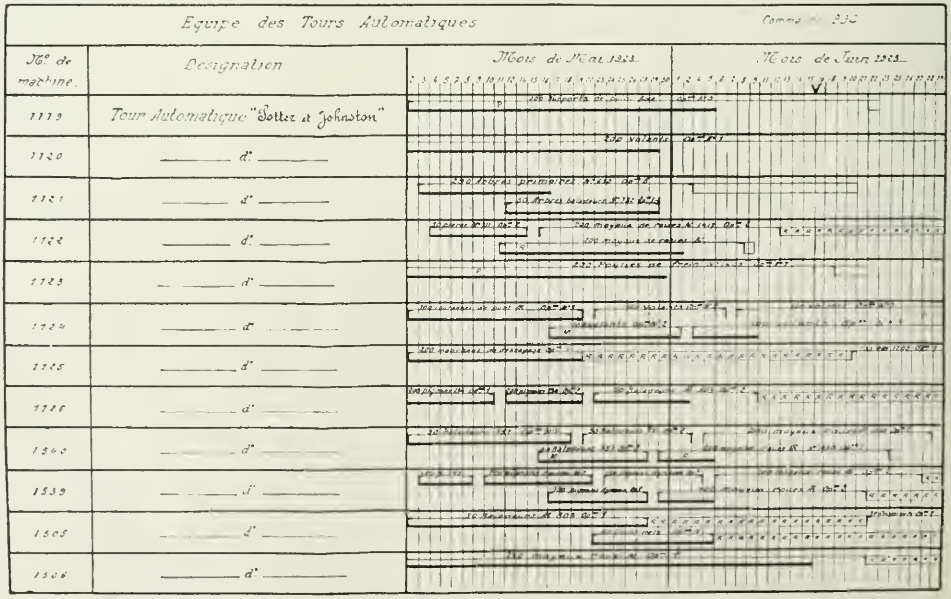


FIG. 3 MACHINE TOOL WORK LAYOUT CHART USED IN THE MANUFACTURE OF THE HOTCHKISS MACHINE RIFLE

Schedule of jobs on Potter and Johnson automatic lathes with the name of the part to be machined indicated on each layout line.

The interest of the application of the Gantt Chart in the Hotchkiss Works in France is due to the fact that it was applied in two separate establishments belonging to the Société and whose scope and kind of products are entirely different. One of these establishments, situated at Saint-Denis, near Paris, produces automobiles. In the other at Levallois-Perret, also near Paris, are manufactured the Hotchkiss machine gun and machine rifle. As a result of the difference in the products, the characteristics of machine work in the

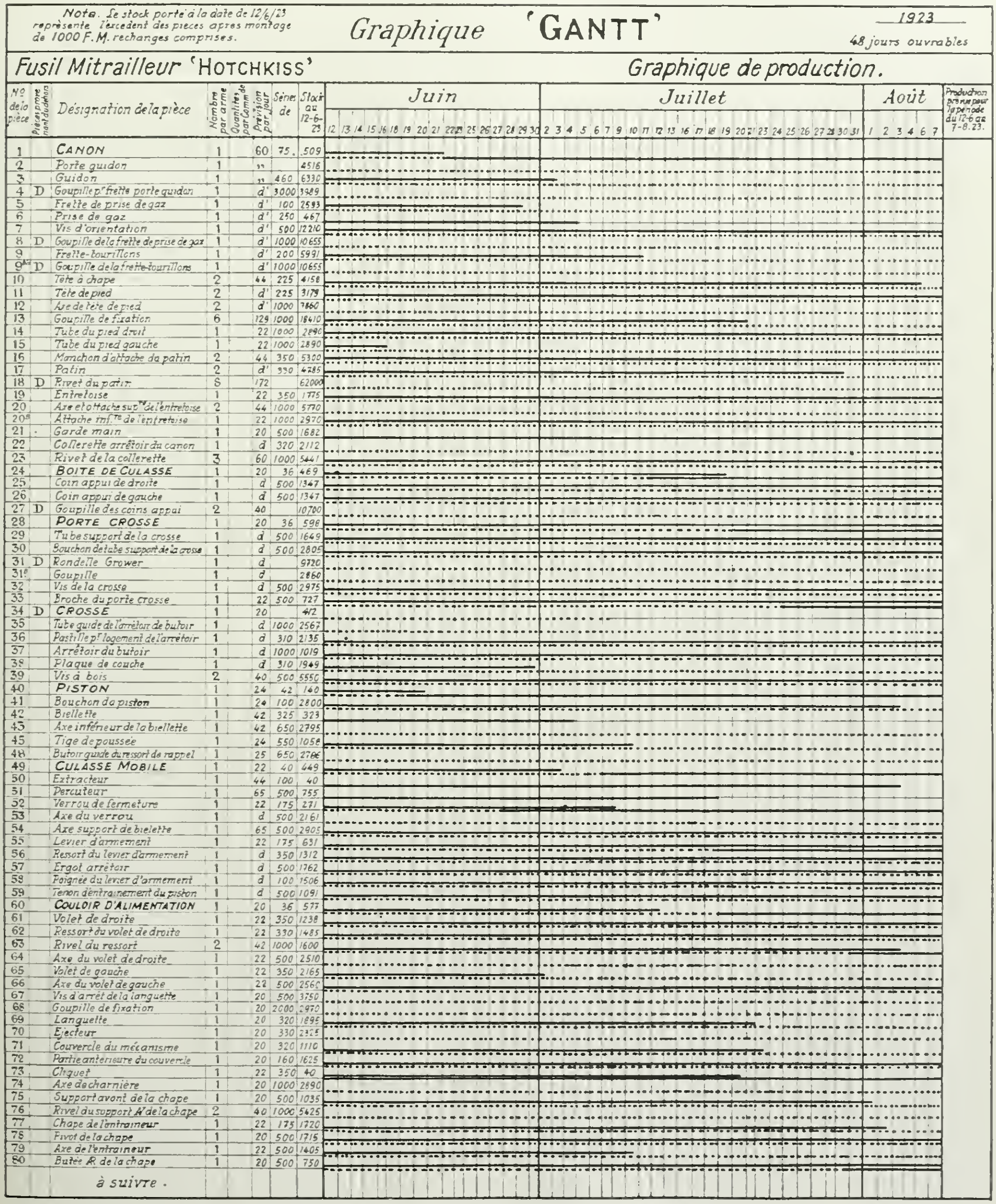


FIG. 4 DAILY MACHINE TOOL WORK PROGRESS CHART

This chart compared with Fig. 3 shows the cause of delay for parts behind schedule. Dotted lines indicate parts in stock when chart was adopted.

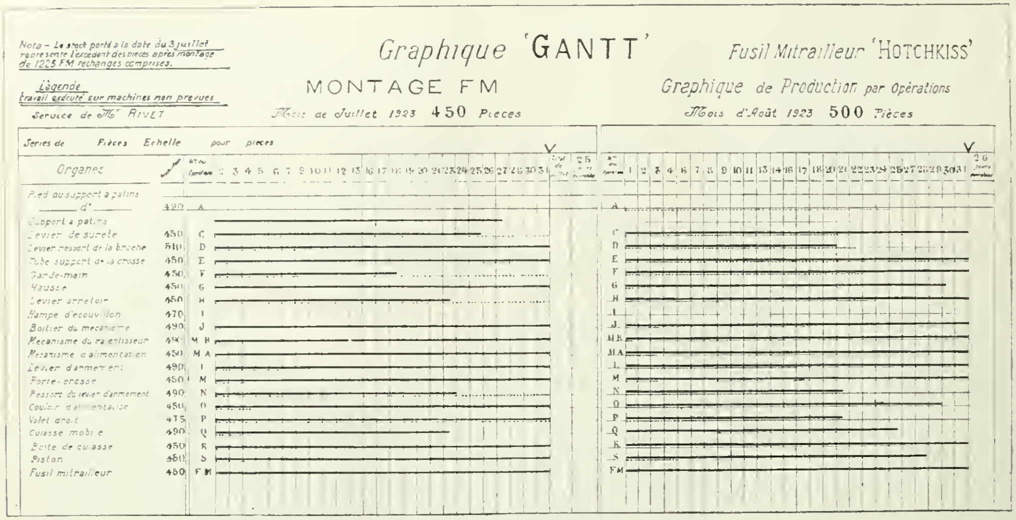


FIG. 5 MACHINE-RIFLE ASSEMBLING PROGRESS CHART

For July 450 rifles were scheduled and for August 500. The last line of each chart shows that the output was actually attained.

two establishments are also quite different. An automobile chassis is composed, as a rule, of a great quantity of parts but, with a few exceptions, the number of machine operations on each of these parts is relatively few and simple. In the Hotchkiss machine rifle (taking this as an example), on the contrary, the number of parts is small but, as a rule, each part comprises a large number of machine operations.

The first task that was taken up was to decide which types of charts should be adopted to give the best practical results in each of the plants. After a close study of the organization of the work in the shops it was decided to establish the following charts:

1. At the Saint-Denis Works (automobiles):
    (*a*) The Progress Chart as applied to the stores department.
    (*b*) The Layout Chart as applied to machine tool production.
2. At the Levallois-Perret Works (machine gun works):
    (*a*) The Layout Chart as applied to machine tool production.
    (*b*) The Progress Chart as applied to machine tool work done daily on each individual part of machine rifle.
    (*c*) The Progress Chart as applied to the machine rifle assembling department.

In this article are reproductions of specimens of each of the above charts as they were actually constructed by the chart office, adding a few explanatory words for each. We trust that although the indications given on the charts are in French, this will not prevent the clear comprehension of the examples shown.

Stores Department Progress Chart (Fig. 1)

The automobile chassis is divided into groups of parts, the groups being essentially as follows:

Engine	(*Moteur*)
Clutch	(*Embrayage*)
Gear box	(*Boite de vitesses*)
Rear axle	(*Essieu moteur*)
Steering gear	(*Direction*)
Front axle	(*Essieu Avant*)
Frame	(*Chassis*)
Gasoline tank	(*Réservoir à essence*)

The example given relates to the gear box or rather to part only of the gear box in order to economize space.

The orders were issued for raw material (rough castings, forgings, etc.) so that deliveries should be made in predetermined quantities during each successive period of two weeks. The required quantities are shown as usual in single and accumulative numbers on the chart and correspond to each period (April 2 and 16—May 1 and 16). As shown by the fine lines, the deliveries were in some cases irregular—some of the parts coming in in large quantities according to schedule while others were not delivered on time. This is especially true of the drive shaft *(arbre primaire)*.

Machine Tool Work Layout Chart (Fig. 2)

A chart of this type was made out for each of the main parts of the machine rifle. The example shown relates to the breech block *(culasse mobile)*. The machine tool work comprises 55 consecutive operations, most of these being milling operations (*fraisage*). The scheduled monthly output was 572 pieces. The dotted lines show the parts in stock, manufactured before the chart was first made out. As is usual in the Gantt Chart the length of lines show, according to scale, the number of parts manufactured compared with scheduled output. The space between two consecutive vertical lines corresponds to 23 parts for the month of July and 22 parts for the month of August.

Machine Tool Work Layout Chart (Fig. 3)

The example shown relates to work done on a battery of Potter and Johnston Automatic Lathes. It will be observed that for certain of these machine tools the chart shows a scheduled interval of one day between two consecutive jobs. This interval was allowed purposely for setting up the machine for the next part to be produced. On each line is marked the name of the part to be machined according to schedules. The spaces marked "R" show the time set apart for repairs. The schedule was prepared for the entire month of June. But in the middle of this month the shop underwent a complete change of organization which accounts for the interruption of the chart lines.

Daily Machine Tool Work Progress Chart (Fig. 4)

This chart shows the work accomplished daily on every part of the machine rifle as compared with scheduled output. The lines that overlap show the output ahead of schedule at certain dates. By comparing this chart with the Machine Tool Work Layout Chart described above, it is easy to find out the cause of delay for such parts as were behind the schedule. On examining Fig. 4 it is seen that certain parts are behind time, for instance the "gas plug" (*prise de gaz*), the "breech lock connecting link" (*biellette*), and the "firing pin" *(percuteur)*. The trouble was, in the first case, a lack of accuracy in the drilling of the gas channels in the plug, and for the two others, defective heat treatment. By constantly calling attention to the delay in output this chart very materially helped by calling immediate attention to difficulties as they occurred.

As stated previously the dotted lines show the parts in stock manufactured before the Gantt Chart was first adopted.

Machine-Rifle Assembling Progress Chart (Fig. 5)

The scheduled output was 450 machine rifles for July and 500 for August. Although the last line shows that this output was actually obtained this result was in reality due to the fact that parts already in stock before the chart was made out, were used for assembling the rifles. As a matter of fact some more or less serious stoppages occurred for certain parts, such as the "hand guard" (*garde-main*), the "strip abutment" (*levier arrêtoir*), and the "breech block" (*culasse mobile*). All this was clearly demonstrated by the chart and the proper steps were taken accordingly, to remove the causes of the delay.

Progress-of-Work Board for Repair Jobs

MAINTENANCE and repair work are coming in for their share of planning, scheduling, time and job analysis, and the other elements of management that already are extensively in use for regular production activities. Particularly when repair work is done in a shop equipped for the purpose, rather than at the place where the machine or apparatus requiring the work is located, it is possible to apply principles successful in manufacturing operations.

A western automobile repair shop has devised a progress-of-work board much like the production control board adopted for keeping track of manufacturing progress throughout a plant. A picture of this board is shown in Fig. 1. At the left is a column containing holders for the insertion of work slips on which are recorded the owner's name, license number, and job number for each car under repair. The rest of the board is ruled off into squares—horizontally by jobs, vertically by nature of work.

The first six vertical columns are headed with the days of the week, and alongside of each job a pin is stuck in the board under the day on which the work is promised for completion. The remaining vertical columns are grouped by automobile parts into sections headed—motor, clutch, transmission, propellor shaft and line drive, differential, wheels, brakes, rear axle, front axle and steering gear, springs, and miscellaneous.

The columns under each group are headed to show the details of work to be done on the automobile. Thus, the 17 items under motor are labeled—rebore, bearings, valves, tune up, valve lifters, etc.

Index Number
658.532 Progress chart

Pins are stuck in the board, under each column which describes work to be done, and on the horizontal line for the particular machine to be repaired. When each part of the job is completed the workman removes the corresponding pin. The foreman can tell at a glance just how much work is ahead of his men on each automobile and for the shop as a whole.

While developed for the special work of automobile repairs, this progress-of-work board is directly adaptable to repair work in manufacturing plants. It is easy to make and saves time and money from the start.

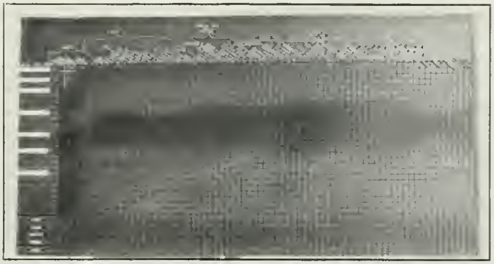


FIG. 1 CONTROL BOARD FOR REPAIR WORK

THE EDITORS' PAGE

Putting It Up to the Coal Consumer

THE report of the special committee of the American Engineering Council, reviewed in these pages in the August issue, places the initiative for bettering our coal situation upon the coal consumers. The cure is—STORE COAL! To make this possible deliveries should be ordered on a uniform monthly schedule. It is gratifying to see the general acceptance of the practicability of this program as shown by newspaper editorial comment:

Philadelphia Bulletin

What the engineers suggest is applied common sense.

Cleveland Times

There has long been a belief in the minds of those giving the coal problem serious consideration that eventually storage of coal would save the country from dangers of shortage in times of unusual demand or when strikes should hold up production at the mines or distribution by railroads. Just how this sensible proposal could be carried out in a practicable way, however, has never before been worked out on a scientific basis.

Dayton News

After everything is said and done it must be perfectly apparent to any serious thinking individual that this matter of supply and demand with the coal situation revolves about the subject of the possibilities and proprieties of shortage. When we have learned this lesson the solution to the coal problem will be easier.

Chicago News

The report of the coal-storage committee of the American Engineering Council, which has received the approval of federal, state, and local agencies, is not open to criticism. This interesting document deserves the attention of every coal consumer in the country. Indeed, it is chiefly addressed to the consumers. It advocates the policy of annual purchases of coal on the basis of uniform monthly deliveries. The idea is novel and worthy of the body of distinguished engineers from which it emanates.

Columbus Journal

The suggestions made are good. The difficulty will be to induce coal consumers in large numbers to act upon them. People hate to spend their money for necessities until they positively have to. And it is a little hard sometimes to make them see, and to act accordingly, that they are themselves in no small degree responsible for troubles which they have been wont to blame with angry enthusiasm upon the vested interests.

Springfield, Ill., Register

A suggestion made in the report of the coal storage committee of the American Engineering Council is worthy of the attention of every coal consumer in the country as well as operators and miners. Coal mine operators and coal-trade journals have urged consumers to buy and store coal during the late spring and summer months as one means of stabilizing the industry, but the connection between that recurrent plea and the paramount problem of the industry is not always sufficiently emphasized.

Springfield, Mass., Union

The point emphasized is to get much of the year's supply of coal to the actual place of consumption during the season of the smallest consumption. This is in line with the advice recently extended to Massachusetts consumers of anthracite by Chairman Hultman of the Commission of the Necessaries of Life, who strongly urged summer buying as the most practical method of obviating a fuel famine and as a preventive of the price inflation that usually accompanies a coal shortage.

Seattle Times

The feature of the report which deals with the plan to store coal during the summer months in order to relieve the railroads in the fall, at a time when they are moving the country's crops, has a special interest for the Pacific Northwest. It was demonstrated last year that danger of car shortages can be materially lessened by the movement of such commodities as can be readily stored during the comparatively quiet period of summer. With this part of the year's work out of the way, the transportation lines can devote virtually all their motive power to the movement of crops.

If these editorial opinions are indications of a growing public opinion the coal situation will soon be up to the consumer in an inescapable way.

To add emphasis to it all there is impending a "grand hustle" for next winter's coal, if not an actual panic. The Department of Commerce and Interstate Commerce Commission have already issued warnings. The rate of production and deliveries of bituminous coal to consumers for 1924 if unaccelerated will yield a total some 50,000,000 tons below the average of the past seven years (excluding the strike year of 1922).

Conclusions based on an extensive engineering investigation, experience of those who know the operation of the coal industry, opinions of the public press, force of circumstances—all these combine to put the industrial coal situation squarely up to the consumer. We may confidently expect improvement, for no man will refuse to help himself, once the way is clearly before him.

The Plant Library as a Productive Factor

IT would be hard to find an industrial plant of importance without its library—purely technical books perhaps, relating to the particular industry, or more broadly and better based, covering a wider range of information, but in either case a plant library.

While the importance of the library is recognized, its best utilization is not so well understood. It should be looked upon as a storesroom of information almost as valuable to the plant activities as the storesroom of material itself. And it should be handled in much the same way. Its information is of undoubted value but only when it is used, and to the extent to which it is used. If its information is only accessible to those who are already so well informed and of sufficient leisure to be able to "dig out" the desired information themselves its usefulness is greatly restricted. If it is not kept up to date and supplied with all the information that should be found there, it fails again of its greatest usefulness.

The recognized ideal of the public library is that of an information service. In a recent address before the Special Libraries Association, A. E. Bostwick of the St. Louis Public Library, brought this idea out in some detail. Speaking of library service to special groups he says:

> Service to a group includes purchase of books on the subjects in which they are interested, making them available in or out of the library, calling attention to them through the catalogue or otherwise, rendering information service directly by telephone or in writing. . . .
>
> Material required for this use goes beyond the printed book and includes catalogues, pamphlets, leaflets, and manuscript material. Information service by telephone is very effective. Effort should be made to have it rapid and accurate and to inform the inquirer when he may expect his answer if this requires much search.

This ideal of information service applies to the plant library quite as forcefully as to the public library. It should, as already intimated, be as carefully arranged and classified and indexed as is the storesroom of material. It should also be as carefully and adequately supplied with up-to-date information, so that any reasonable requisition upon it can be satisfied promptly and adequately.

From Confusion to Order

DR. MICHAEL PUPIN gives a most instructive picture of the physical foundation of organic life in an article entitled "From Chaos to Cosmos" in the July issue of *Scribner's Magazine*. Upon this foundation and the laws for its co-ordination are built our management fundamentals and their application.

Pupin refers to the Newtonian law of action between material bodies and to the Maxwellian laws of electrical motions, saying that "they are the splendid outcome of long-continued efforts of the human intellect during a period of nearly 400 years" and "a more complete analysis of the beauty of law and order in the co-ordinated physical world was never given by mortal man". He shows the difference between the orbital motion of a planet, which is co-ordinated, and the motion of the molecule of a hot body interfered with by countless collisions with the motions of neighboring molecules, which is an example of non-co-ordinated motion.

He then refers to the work of Sadi Carnot, pointing out that the steam-engine is the oldest co-ordinator studied by man and that its development marked the beginning of a new science. In this setting the steam-engine is a co-ordinator of the non-co-ordinated molecular energy of steam; a transformer of the activity of a molecular chaos into a cosmos of co-ordinated activity, the chaotic activity of the microcosm into co-ordinated activity of the macrocosm.

This same philosophic thought underlies the development of management. The continuing attempt has been to formulate new concepts in industry dealing with the confused efforts of human beings. No imaginable law of action can describe the activities of a single individual, closely surrounded as he is by scores or hundreds of other workers, but his activities and efforts can be directed along predetermined plans and can be made to achieve a worthy object.

In a phrase, management has tried to reduce confusion to order; to change from "hit-or-miss," "rule-of-thumb," "by-guess and by-golly," methods to scientific observation, analysis, and calculation.

Accepting the concept that the steam-engine or steam turbine transforms the chaotic force of heat into controlled power, it is not difficult to trace a parallel with the concept of management:

PHYSICAL DEVELOPMENT	MANAGEMENT DEVELOPMENT
Steps in transforming chaotic force of heat into controlled power.	*Steps in transforming chaotic efforts of industrial executives and workers into co-ordinated work.*
1. Confine chaotic force in steam boiler or other pressure vessel.	1. Confine unplanned efforts within boundaries through functionalization.
2. Apply force in given direction; against piston of reciprocating engine or blades of steam turbine.	2. Apply effort through methods and systems to accomplish predetermined result.
3. Secure reliable, efficient mechanical power.	3. Secure co-ordinated, efficient mental and manual labor.
Result:	*Result:*
Power used to promote human welfare.	Work in industry to produce goods for the service of mankind.

An American physicist, Gibbs, discovered the mathematical method by which we can calculate that part of non-co-ordinated energy which is available for co-ordinated external service. In like manner, our knowledge of management fundaments has been unfolding. Each shows how to achieve the beauty of law and order in human affairs and make non-co-ordinated energy render service.

Management Week, October 20 to 25, 1924

THE general subject of Management Week this year is to be "Better Management Through Budgeting." Meetings will be held in 65 cities under the direction of the American Management Association, American Society of Mechanical Engineers, National Association of Cost Accountants, Society of Industrial Engineers, and the Taylor Society, assisted by local Chambers of Commerce, Rotary, Kiwanis, and Lions Clubs, and civic organizations. Schools and colleges will be encouraged to develop meetings and talks will be arranged for, if possible, from the large radio broadcasting stations.

NEWS OF EQUIPMENT
FOR THE MANAGEMENT

This department is conducted to give our readers essential facts regarding items of industrial equipment recently placed on the market, that may be used to increase production or lower costs. Each item is indexed according to the Dewey Decimal System so that it can be accurately filed for future reference. The editors will be glad to furnish additional information about any item. All information given is obtained from reputable manufacturers, and MANAGEMENT AND ADMINISTRATION accepts it as reliable.

Pay-roll Machine

Index Number
651.264 Mechanical
calculations

WRITING a pay check, pay check stub, pay-roll, and individual pay record card at one operation and at a high rate of speed has been made possible by the development of a new carriage for the Public Utilities machine made by Burroughs Adding Machine Company. Pay envelopes can be written instead of checks with equal ease.

Speed and simplicity are the features claimed by the manufacturers.

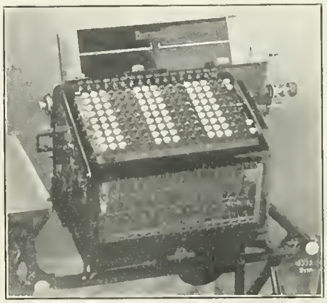
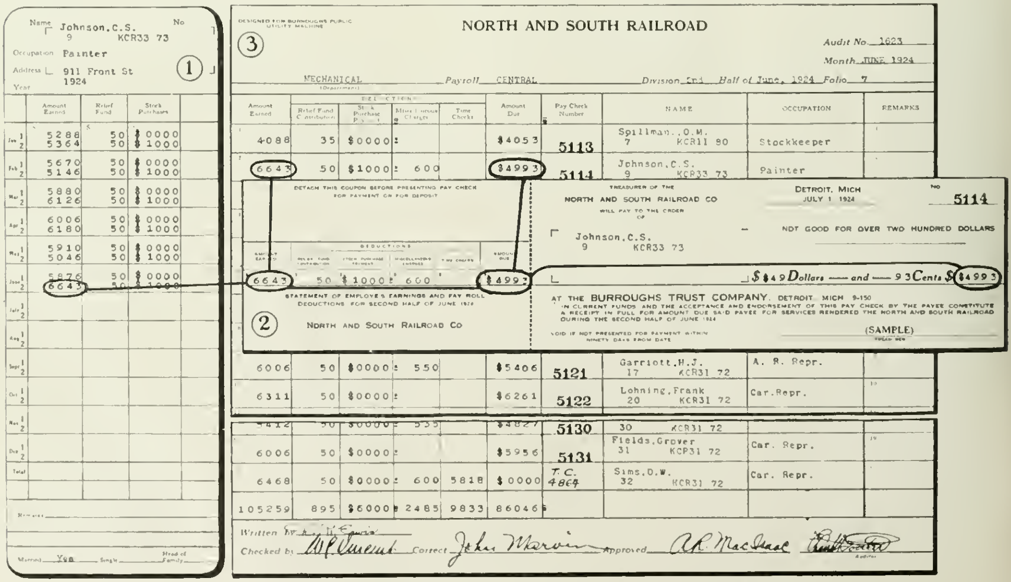


FIG. 1 PAY-ROLL MACHINE

When names, addresses, and similar material have been filled in on the pay-roll forms previously, the machine will handle the necessary computations and print actual pay-roll data for about 150 checks an hour. Simplicity is obtained by making the operation largely automatic. The operator uses the keyboard only twice to accomplish all the computations and printing of one set of forms. The rest of the operation is done automatically by the machine when the operator depresses the operating bar.

The essential features of the new carriage are two chutes that permit the pay record card and pay check to be dropped down in front of the previously inserted pay-roll sheet but not around the platen. The sheet receives a carbon impression of the figures printed on the pay check stub. The record card and pay check are automatically stopped at the right position when they are dropped in the chute.

The operator sets up on the keyboard the amount earned by the employee, any deductions to be made, and then depresses the operating bar. The machine prints the figures on the pay record card (See *1* Fig. 2), then automatically tabulates to the left, and repeat prints the same figures on the pay check stub, and, by carbon impression, on the pay-roll sheet (*2* and *3* Fig. 2). Then the



①

Name Johnson,C.S. No
9 KCR33 73
Occupation Painter
Address 911 Front St
Year 1924

		Amount Earned	Relief Fund	Stock Purchases	
Jan	1	5288	50	$0000	
	2	5364	50	$1000	
Feb	1	5670	50	$0000	
	2	5146	50	$1000	
Mar	1	5880	50	$0000	
	2	6126	50	$1000	
Apr	1	6006	50	$0000	
	2	6180	50	$1000	
May	1	5910	50	$0000	
	2	5046	50	$1000	
June	1	5876	50	$0000	
	2	6643	50	$1000	
July	1				
	2				
Aug	1				
	2				
Sept	1				
	2				
Oct	1				
	2				
Nov	1				
	2				
Dec	1				
	2				
Total					

Remarks

Married Yes Single Head of Family

③

DESIGNED FOR BURROUGHS PUBLIC UTILITY MACHINE

NORTH AND SOUTH RAILROAD

Audit No. 1623
Month JUNE 1924
MECHANICAL (Department) Payroll CENTRAL Division 2nd Half of June, 1924 Folio 7

Amount Earned	DEDUCTIONS				Amount Due	Pay Check Number	NAME	OCCUPATION	REMARKS
	Relief Fund Contribution	Stock Purchase Payment	Miscellaneous Charges	Time Checks					
4088	35	$0000			$4053	5113	Spillman,.O.M. 7 KCR11 80	Stockkeeper	
6643	50	$1000	600		$4993	5114	Johnson,C.S. 9 KCR33 73	Painter	
6006	50	$0000	550		$5406	5121	Garriott,H.J. 17 KCR31 72	A. R. Repr.	
6311	50	$0000			$6261	5122	Lohning,Frank 20 KCR31 72	Car.Repr.	
[illegible]	50	$0000	[illegible]		[illegible]	5130	30 KCR31 72		
6006	50	$0000			$5956	5131	Fields,Grover 31 KCP31 72	Car. Repr.	
6468	50	$0000	600	5818	$0000	T. C. 4864	Sims,D.W. 32 KCR31 72	Car. Repr.	
105259	895	$6000	2485	9833	86046				

Written by
Checked by W. P. Vincent Correct John Marvin Approved A. R. MacIsaac
Auditor

②

DETACH THIS COUPON BEFORE PRESENTING PAY CHECK FOR PAYMENT OR FOR DEPOSIT

Amount Earned	DEDUCTIONS				Amount Due
	Relief Fund Contribution	Stock Purchase Payment	Miscellaneous Charges	Time Checks	
6643	50	$1000	600		$4993

STATEMENT OF EMPLOYE'S EARNINGS AND PAY ROLL DEDUCTIONS FOR SECOND HALF OF JUNE 1924

NORTH AND SOUTH RAILROAD CO

TREASURER OF THE
NORTH AND SOUTH RAILROAD CO
DETROIT, MICH
JULY 1 1924
No 5114
WILL PAY TO THE ORDER OF
NOT GOOD FOR OVER TWO HUNDRED DOLLARS
Johnson,C.S.
9 KCR33 73
$ $49 Dollars — and — 93 Cents $ $4993
AT THE BURROUGHS TRUST COMPANY, DETROIT MICH 9-150
IN CURRENT FUNDS AND THE ACCEPTANCE AND ENDORSEMENT OF THIS PAY CHECK BY THE PAYEE CONSTITUTE A RECEIPT IN FULL FOR AMOUNT DUE SAID PAYEE FOR SERVICES RENDERED THE NORTH AND SOUTH RAILROAD DURING THE SECOND HALF OF JUNE 1924
VOID IF NOT PRESENTED FOR PAYMENT WITHIN NINETY DAYS FROM DATE
(SAMPLE)
TREASURER

FIG. 2 FORM OF PAY RECORD CARD, PAY CHECK AND STUB, AND PAY-ROLL

operator sets up on the keyboard any further deductions and the amount due to the employee, and presses the operating bar a second time. These figures are printed on the check stub and pay-roll sheet. The machine then automatically tabulates to the left and prints the last figure set up on the keyboard on the pay check. First is printed the amount in dollars only, then the amount in cents only, and finally the amount of both dollars and cents (2 Fig. 2), and the operation on that check is completed.

After printing in the third position on the check the carriage automatically spaces the pay-roll sheet up one line, returns to position for printing the next pay record card, and tilts back to facilitate removal of the card and check just printed and insertion of new ones.

Several safeguards and checks on accuracy are provided automatically by the machine. When the pay check is printed the machine automatically prints ciphers in the dollar space if the amount is less than one dollar and prints extra dollar marks when the amount is less than $100 as shown in the sample check of Fig. 2. If there are no cents or no deductions to be made ciphers are automatically printed to facilitate rechecking. The machine, in automatically spacing the pay-roll sheet after each check is written, brings the name of the next employee just above the line finder so the operator can check it with that appearing on the record card and check he is about to insert in the machine. While the machine is printing checks it is automatically totaling the amounts of each column on the pay-roll sheet. When a sheet is filled out, depressing the totaling key prints the totals at the foot of each column, thus providing a quick check on the work.

Portable Meters

Index Number
621.3173 Voltmeters

SPECIAL portable thermo type voltmeters and milliammeters are now on the market. Important applications of these instruments are the measurement of high frequency circuits of moderately low capacity and also low voltage alternating current measurements of ordinary frequencies.

The General Electric Company, who makes the meters, has used the D'Arsonval instrument element, mounted in a standard case. This element is actuated, however, from a vacuum thermocouple, located inside the carrying case, thus making the instrument self-contained.

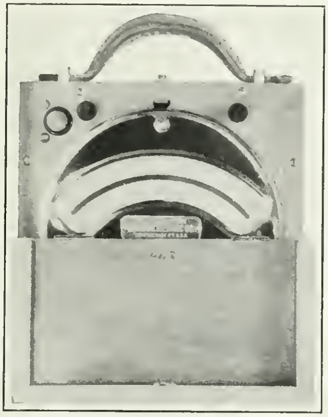


FIG. 1 PORTABLE METER

Voltmeters are being made in ranges from 0.75 to 150 volts and milliammeters can be built for either 20, 25, or 30 milliamperes. The voltmeters are designed to stand loads of 25 to 50 per cent in excess of the normal ratings. All the instruments are highly damped. The resistance of the voltmeters is approximately 40 ohms per volt.

Dump Express Body

Index Number
658.281 Industrial trucks

A DUMP body for attachment to Ford one-ton truck chassis, which can dump its load and return to horizontal while the truck is in motion, is being manufactured by the Griscom-Russell Company. It is called the Jiffy Dump Express Body. The driver can operate the body from his seat, the tail gate opening automatically when the body reaches an angle of 45 deg. and closing again on its return to normal position. It can be furnished with side boards, center division gate, lift and brake attachment, and coal chute tail gate for hauling coal, cement, or similar material.

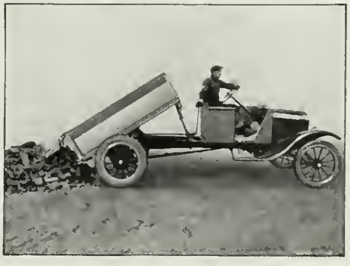


FIG. 1 DUMP EXPRESS BODY

The entire body consists of No. 10 gage reinforced steel, electrically welded. Body and sides are one piece with no seams. A channel iron sub-frame is electrically welded to the body. It is attached to the truck chassis by 4 bolts supplied with body. Its capacity is 1¼ cu. yd., its weight, empty, 700 lb. It is 72 in. long, 44 in. inside width, 4 ft. 7 in. high from ground to top of body when mounted on chassis. Center of load is 5 in. forward of rear axle.

Soot Blower Head

Index Number
621.61 Soot blower

A SOOT blower head which discharges steam at full pressure throughout the entire arc of rotation of the element, and which is easily operated is being manufactured by the Bayer Company. The first condition is obtained by a cylindrical screw and sleeve mechanism connecting the valve, shaft,

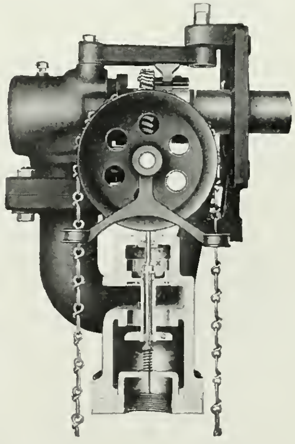


FIG. 1 SOOT BLOWER HEAD

and operating chain which opens the valve so that steam at full pressure is being discharged from the nozzles before the soot blower element commences to rotate.

Ease of operation is obtained primarily through a balanced valve arrangement by which a force of only 21 lb. is required to open a 2 in. valve, with boiler pressure of 200 lb. per sq. in. which may be compared with a force of 706 lb. necessary for operation without this feature. A worm drive is employed for operating the blower head, which is independent of the valve operating mechanism.

This soot blower head can be installed easily and takes up little space, protruding only 12 in. beyond the boiler wall.

Sand Riddle

Index Number
621.7241 Foundry sand

A PORTABLE sand riddle with which, the manufacturers claim, one man can riddle more sand than 10 men can by hand, is being marketed by the Maroa Manufacturing Company. It consists of a framework for supporting a standard size foundry riddle which is given a vigorous reciprocating motion by a 1/8 hp. electric motor operating through steel-cut gears and an eccentric. Reciprocating parts are of hardened steel and brass. Supporting arm is mild steel. Bearings are covered with dust-proof caps. Cable with switch is included as part of motor equipment. Riddle is easily removed for emptying or changing to one of different size mesh. The machine can be suspended by means of 2 hooks, from any support or from an overhead trolley system.

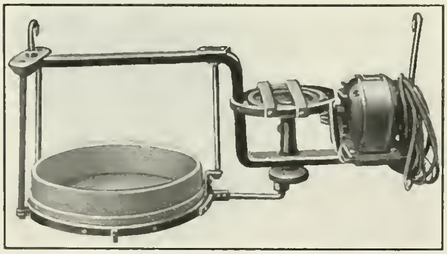


FIG. 1 PORTABLE SAND RIDDLE

Industrial Electric Furnace

Index Number
621.365 Electric furnaces

AN industrial, hearth type, electric furnace for operation up to 1850 deg. fahr. has been developed by Westinghouse Electric and Manufacturing Company. It is well suited for such operations as annealing, hardening, tempering, normalizing, carbonizing, case hardening, vitreous enameling, and laboratory work. Automatic control is provided by means of which a temperature within about 1 per cent of any desired point may be kept as long as necessary. This makes it possible to duplicate heating conditions and enables a predetermined manufacturing schedule to be carried out.

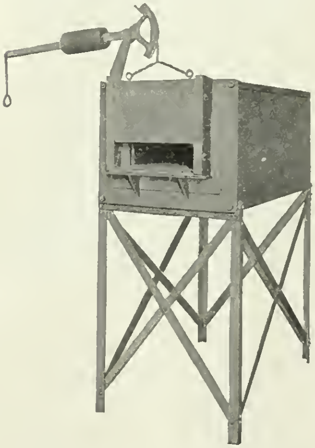


FIG. 1 INDUSTRIAL ELECTRIC FURNACE

The muffle plates, which completely enclose the heating chamber, are perforated so that heat is radiated directly from the heating element to the charge. These elements consist of S-bend coils of nickel-chromium wire placed on all sides of the heating chamber. The muffle plates do not carry any weight. The door of the furnace is suspended by a chain, which, being always on the circumference of an arc at the end of the operating handle, maintains a position directly over the center of the door and prevents the door sticking in its guides when it is opened or closed.

Gasoline Tractor

Index Number
621.281 Industrial trucks

A DISADVANTAGE of electrical tractors is that their operation is limited to the storage capacity of their batteries and to a relatively short distance from the source of electrical energy. To overcome this the Reliance Trailer and Truck Company has developed a tractor whose motive power is a gasoline engine. It is about the size of the usual electric tractor, being 6 ft. 6 in. long, 50 in. wide, and having a 42 in. tread and 50 in. wheel base. It can turn in a circle of 12 ft. diameter.

A heavy steel bumper plate protects the radiator from damage so that it can be used for pushing as well as for towing. Motive power is a Ford engine geared down to give a maximum speed of 11 miles an hr. A 5 or 6 ton load mounted on 4 wheels can be towed easily and if heavier loads are desired a ballast box is provided for adding additional weight to give more tractive power. The engine is cooled by a centrifugal circulating pumping system operating in conjunction with the fan. Internal drive is used, which gives more direct transmission of power to wheels and encloses all working parts in a dust-proof, grease-filled chamber. Regular equipment includes fenders, spring seat, and cozy and comfortably fitted back.

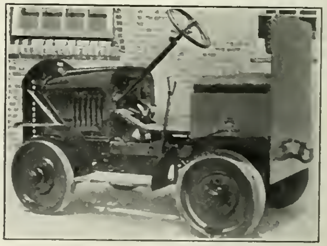


FIG. 1 GASOLINE TRACTOR

Flexible Couplings

Index Number
621.825 Couplings

In the design of direct connected machinery the use of a rigid coupling or a continuous rigid shaft is difficult since it is costly to obtain perfect initial alignment and subsequent operation is quite likely to result in misalignment. A coupling designed to give a degree of flexibility to the drive and especially adapted for use at extreme high speeds is being marketed by Smith and Serrell. It is called the Francke High Speed Type Flexible Coupling. See Fig 1.

Like other types of Francke Couplings, flexibility in all directions—angular, off-center, endwise, and torsional—is obtained by the standard laminated spring construction. This coupling is made of steel and is accessible for inspection or repairs without moving either of the connected machines. Sizes from 2 in. to $7\frac{3}{4}$ in. bore are standard with ratings from $6\frac{1}{2}$ to 98 hp. per 100 r. p. m.

Smith and Serrell is also marketing a pressed steel type Francke flexible coupling designed for use with fractional horsepower motor drives. It is a 3-part, all metal, coupling consisting of two similar pressed steel flanges and a center spring cross. It is flexible in all directions and extensible endwise. Sizes manufactured are for shafts up to $\frac{3}{4}$ in. diam. and for motor drives up to 1 hp. at 1800 r. p. m. See Fig 2.

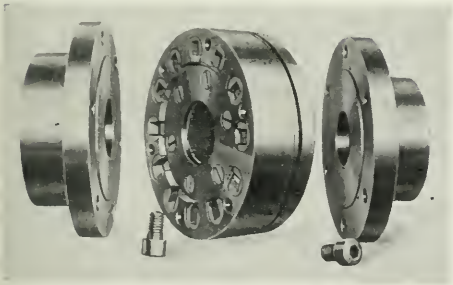


Fig. 1 High Speed Type Couplings

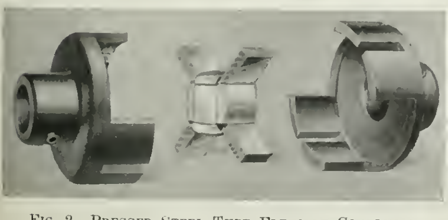


Fig. 2 Pressed Steel Type Flexible Couplings

Bench Drill

Index Number
621.95 Drills

Operators of machine shops, pattern shops, garages, and other work places where drilling forms a considerable part of the work will be interested in the 10 in. Junior Motor Driven Drill recently placed on the market by the Buffalo Forge Company. It is small and requires little space. The makers claim that accurate machining together with an improved drive has resulted in a perfectly balanced and quiet running unit, even when operating at highest speed.

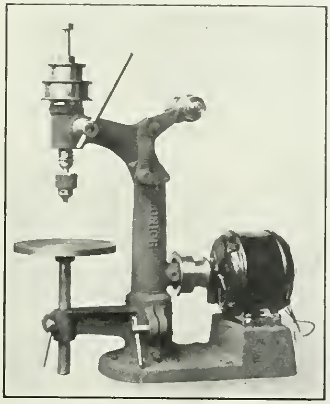


Fig. 1 Motor-Driven Bench Drill

The new drive consists of a $\frac{1}{4}$ hp., 1750 r. p. m. motor with pulleys keyed to the motor shaft. The spindle runs in a large bronze bushing with a 2A Jacobs chuck. Two speeds are provided and shifting from one to the other is accomplished without using tools, because the idler works with a snap socket. The drill has a cast iron frame and an 8 in. diameter table movable horizontally and vertically. Normal driving speed is 550 r. p. m. Height of drill is $27\frac{1}{2}$ in., capacity-holes up to $\frac{3}{8}$ in., net weight 66 lb.

Air Coolers and Nozzle

Index Number
621.51 Air cooling

The Spray Engineering Company has developed a tubular cooler for cooling the ventilating air for electric turbo-generators, which is designed for use where the available cooling water is not fit to spray in the air. For instance, where very muddy or salt water must be used this cooler eliminates the danger of mud or salt deposits inside the generator. It is the same in appearance as the Spraco type-V coolers but cools the air by contact through a set of condenser tubes which are placed in the path of the air approximately in the same location as the nozzles in the type-V cooler. A small quantity of fresh spray water is recirculated and sprayed into the air just above the tubular cooler. This wets the outside of the tubes, thus increasing the rate of heat transfer. The manufacturers claim that most of the increased efficiency is due to the fact that some of this water is evaporated by the air and then recondensed on the tubes.

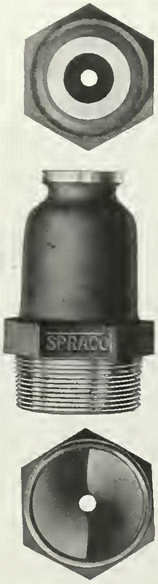


Fig. 1 "Centrif" Nozzle

For use on spraying systems when large amounts of foreign matter, which cannot be eliminated with screens, is present in the water the Spray Engineering Company has developed the "Centrif" nozzle. It is designed with large openings to allow free passage of foreign matter.

There are no bars or grids across the nozzle at any point and a conical spray is produced by centrifugal action alone. Smooth finished bronze is used in the manufacture of the nozzle and the manufacturers say that enough metal is used to insure long life.

Crane Truck

Index Number 658.281 Industrial trucks

An electric platform truck equipped with a crane so that heavy material can be loaded, transported, placed in position, stacked, etc., at a considerable labor saving over ordinary truck operation is being manufactured by the Crescent Truck Company. Fig. 1 shows a Crescent Crane Truck handling old car axles. By using the crane equipment two men do the work while formerly eight were required to load and unload the heavy pieces weighing hundreds of pounds.

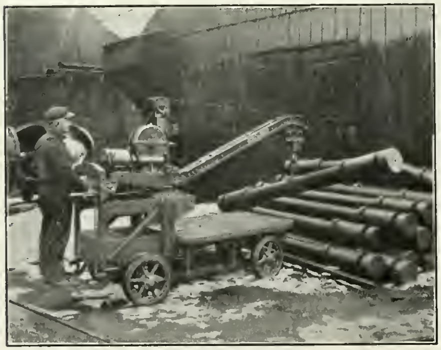


Fig. 1 Electric Crane Truck

The crane has a lifting capacity of 1500 lb. and a hoisting speed of 12 ft. a min. The truck's load capacity is 4000 lb. The crane boom swings through a 180 deg. arc, giving a large operating area without moving the truck. The platform of the truck is 40 x 60 in. and is 23 in. high. Greatest height of the equipment is 79½ in., overall length is 111 in.

Ledger Binder

Index Number 651.4652 Binders

Designed particularly for use with Elliott-Fisher bookkeeping machines but equally serviceable as a regular sectional post binder is the automatic lock binder developed recently by the Baker-Vawter Company. When the cover is dropped over the post it locks automatically, each post having an independent locking unit. This consists of a tapered hollow cone on the cover which forms a V-shaped annular opening around each post. Three steel ball bearings are placed in this opening in such a way that they come in contact with both the post and the tapered cone. This contact forms a locking grip which increases in proportion to the efforts made to raise the cover until the contact is broken by pressing the small levers which elevate the ball retaining cages.

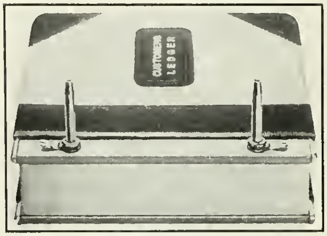


Fig. 1 Automatic Lock Binder

All operating parts are of steel, and metal parts have a new black-satin, rust proof finish, or are of polished nickel or aluminum. Binding is of black leather and corduroy.

Equipment Catalogs

The Monitor Controller Company has issued a folder describing the use of Monitor Adjustable Speed Controllers on machines used in technical high schools for instruction purposes.

A 20-page bulletin containing information about the Fairs held in Leipzig, Germany, has been issued by the Committee in charge. A history and description of the Fair is followed by a list of the branches of business comprising the general sample Fair and the Technical and Building Fairs. Then is given a description of Leipzig and information of value to anyone wishing to attend one of the fairs.

The Brown Hoisting Machinery Company has issued Catalog M-24 showing their line of belt conveyors and equipment. It contains considerable engineering data, for determining proper equipment to use for various services, design and construction information and specifications of Brownhoist equipment.

International Business Machine Corporation has published a broadside on the subject of eliminating red tape by business machines. By means of pictures and short sketches present methods of doing business, aided by modern business machines, are contrasted with those prevailing before the introduction of accounting, tabulating, recording and similar machines into business.

The Norma Company of America, manufacturers of Norma Precision Ball Bearings and Hoffmann Precision Roller Bearings, has changed its corporate name to Norma-Hoffmann Bearings Corporation. Management, personnel, and policies remain unchanged.

Some twelve years ago the Norma Precision Ball Bearing was introduced in America. It found its first market in the automotive field, where it has been used extensively ever since. Later it was adopted in other fields and today is extensively used in all services in which precision ball bearings are necessary. About two years ago the Norma Company acquired the American rights in the patents, trademarks, and business of the Hoffmann Manufacturing Company, Ltd., of England, manufacturers of precision roller bearings. Since that time Hoffmann Precision Roller Bearings have been adopted in increasing numbers by American manufacturers and the change in name is to permit the company to realize fullest value from the two nationally advertised trademarks, "Norma" and "Hoffmann" as well as better to describe the nature and wider extent of the business.

CURRENT INFORMATION INDEX
FOR THE MANAGEMENT

The material indexed in this department is selected by the editors of MANAGEMENT AND ADMINISTRATION from upwards of 150 magazines; it also includes the publications of some 50 book publishers and professional societies as far as these are of managerial interest to industrial executives. The items are prepared and classified by the Engineering Societies Library in New York City. The decimal number at the right of each item is the index number and indicates the place the article or book will take when filed in accordance therewith in the classified subject scheme. If articles are grouped according to these numbers, like subjects will automatically fall together and related subjects will follow in logical sequence. Photostat copies of any magazine article indexed will be supplied by The Ronald Press Company at a price of 25 cents the page. When ordering photostats please identify the article by quoting from the index: (1) Title of article; (2) Index number; (3) Name, date, volume number, and page number of periodical in which the item appears. A remittance of 25 cents a page should accompany the order. The books and pamphlets indexed can be procured from The Ronald Press Company or their respective publishers.

Accounting

Cost Keeping for Concrete Products Plants. 657.452
W. J. Rathke. *Buildings*, June 25, 1924, v. 61, pp. 1413-1415. Comments on accounting systems in concrete plants.

Costs for Executives. 657.452
N. A. Hall. *Industrial Management*, July 1924, v. 68, pp. 14-17. Cost systems and methods of assembling and applying the overhead. Discusses standard costs.

Evaluating the Cost Department. 657.452
Mechanical Engineering, August 1924, v. 46, pp. 477-479. A cost accounting system functioning properly should indicate, accurately and economically, standard, actual and current costs of parts, and offer data pertaining to the efficiency of the factory and employee.

Method of Balance Sheet Analysis. 657.36
Stephan Gilman. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 147-150. Suggests methods for obtaining for executives, information which balance sheet figures do not clearly reveal.

New Problems of the Accounting Office 657.5
A. J. County. *Railway Age*, July 19, 1924, v. 77, pp. 109-112. Recommending improvements in the accounting and clerical requirements for railways.

Advertising

Bigger Results From Advertising. 4—Records That Reveal Your Best Media. 659.131
H. Herd. *Business Organization*, July 1924, v. 10, pp. 269-273. Questions to be considered in choosing suitable newspapers and magazines as a medium for advertising. Emphasizes the value of analyzing returns.

How Hyatt Roller Bearing Uses the Business Papers. 659.1
P. C. Gunion. *Advertising and Selling*, July 30, 1924, v. 3, pp. 17, 53-54. Advertising method brought to highest efficiency, showing design according to the subject of the magazine in which it appears.

Hyatt's Industrial Advertising Plan. 659.1
Philip C. Gunion. *Printers' Ink*, July 17, 1924, v. 128, no. 3, pp. 107-108, 111. Details of the plan of the Hyatt Roller Bearing Company—the sales plan, co-operative advertising, copy, illustrations, choice of papers, etc.

Industrial Advertising Achievement in the United States. 659.1
Bennett Chapple. *Advertising and Selling Fortnightly*, July 16, 1924, v. 3, pp. 25, 44. Briefly cites cases where advertising has brought success to companies in the fields of power, utilities, construction, mining, and manufacturing.

Marketing the Technical Product. 659.13
Eric N. Simons. *Mechanical World*, June 27, 1924, v. 75, pp. 402-403. Points out the value of circulars as an advertising medium.

Building and Equipment

The Bond of Safety at Hammermill. 658.283
John M. Sandel. *National Safety News*, July 1924, v. 10, no. 1, pp. 9-12. Descriptions of the safety guards, brakes, signal systems, and numerous other devices used by the Hammermill Paper Co. for the prevention of accidents.

How to Work With Your Architect. 658.2
F. Morse Holcomb. *Factory*, July 1924, v. 33, pp. 42-45, 128. Co-operation between manufacturer and architect is essential. Structure best adapted to the manufacturing process and good architectural effect of the building, can thus be obtained.

Indicts Faulty Shop Lighting. 658.24
Michigan Manufacturer and Financial Record. July 5, 1924, v. 34, pp. 5, 27. Points out the need for better lighting, not only in the factory, but also in the home and in the schoolroom. Urges examination of children's eyes.

Modern Maintenance of Plant and Equipment. Fire and Accident Prevention. 658.284
W. G. Ziegler. *Industrial Management*, July 1924, v. 68, pp. 6-13. Describes and illustrates fire prevention and fighting equipment, and other accident prevention devices.

Standardization of Painting Practice. 658.2
R. C. Sheeler. *Industrial Management*. June 1924, v. 68, pp. 25-28. Illus. Considers peculiar problems of industrial plants and discusses color schemes for identification purposes.

Unit Costs in Installing Systems of Lighting. 658.24
D. H. Tuck. *Industrial Engineer*, July 1924, v. 82, pp. 329-332, 356. Illus. Methods of obtaining estimates of costs, when the area to be lighted, foot-candles of intensity, and type of equipment to be used are known.

Economics

Are We a Creditor or Debtor Nation? 382
R. H. Tingley. *American Industries*, July 1924, v. 24, pp. 33-34. Discusses statement of the Department of Commerce, that the country rolled up an adverse balance in 1923 amounting to $152,000,000.

Die Augenblickliche Lage des Maschinenbaues. 338
K. Lange. *Maschinenbau*, June 12, 1924, v. 3, pp. 623-626. Machine industry and how it is affected by the present German industrial crisis. Urges co-operation between manufacturers and purchasers.

The Banker as a Lender. 332.7
O. Roberts. *Business Organization*, July 1924, v. 10, pp. 261-266. Factors to be considered by a banker in analyzing the balance sheet of a firm, from a credit viewpoint.

Credit Insurance. 368.8
Saul B. Ackerman and John J. Neuner. 98 pp. The Ronald Press Co., New York. $1.25. The use of credit insurance has grown rapidly during the past few years but there has been no corresponding development of literature on the subject. While the principle underlying credit insurance is fundamental to all insurance—equitable distribution among the many of the excessive losses of the few—the application of the principle to commercial credits involves a number of technical factors that are highly specialized. These factors are clearly stated and fully explained in this book by the authors who are specialists in the credit insurance field.

A Formula for Determining Probable Interest Rates. 332.81
H. P. Gillete. *Railways*, June 1924, v. 61, p. 1329. Includes chart giving bond yields

for industrial, utility, railway, and municipal bonds 1903-1925.

How to Keep a Business Growing. 338
Henry Ford. *The Automotive Manufacturer,* June 1924, v. 66, pp. 17-20. Principles underlying supply and demand. Quality of commodity will increase quantity demand. Growth of automobile industry used as example.

Importing as a Science. 382
J. A. Dunnage. *Business Organization,* July 1924, v. 10, pp. 249-254. Emphasizes the need for firms to know the various means by which cargo is landed, warehoused, and cleared through the ports. Suggests some general principles.

Industrial Hospital in New York. 36
Henry Wood, Jr. *American Industries,* July 1924, v. 24, p. 35. Describes work of the Reconstruction Hospital devoted to accident victims.

Measures Business by Pig Iron. 338
Iron Trade Review, June 10, 1924, v. 75, pp. 95-96. Charts. Index of business based on record of blast furnace operations designed to be a practical indicator of the investment market and a forecast of the tides of trade.

The National Government and Business. 33
R. J. Swenson. 475 pp. The Century Co., New York. $4. Essential political, legal, and economic aspects of the relation of the national government to business are treated in an exhaustive and authoritative manner. Nearly every statement or interpretation made by the author is supported by a court decision or by some eminent authority on the particular subject involved. Contents are divided into 6 parts; government aids to business; constitutional position of property in the United States; national administration of currency and finance; law of public service; national regulation of commerce; and national regulation of combinations in restraint of trade. Provides a valuable reference book for business men in determining what influence the national government has over their business.

The Platform of American Industry and Its Reception by the Major Political Parties. 33
J. A. Emery. *American Industries,* July 1924, v. 24, pp. 5-7. Convention planks adopted by the Republican and Democratic parties affecting modern industry.

Preparing a Federal Reserve Review of Credit and Business. 338
W. Randolph Burgess. *American Bankers' Association Journal,* July 1924, v. 17, pp. 33-34. The monthly reviews of credit and business conditions, issued by the Federal reserve banks, sources drawn upon, gathering and analysis of statistics, and the purposes they serve.

Putting the American Market Under the Microscope. 380.012
Paul T. Cherington. *Advertising and Selling Fortnightly,* July 16, 1924, v. 3, pp. 15, 60-61. Shows how the complexity of the American population, and the various customs of the people must be taken into consideration in marketing a product.

Selecting a Bank. 332.1
G. A. O'Reilly. *Credit Monthly,* Aug. 1924, v. 26, pp. 18, 30-31. Claims that most people select their bank because of some feature of "unusualness." Urges bankers to be mindful of this.

Social Adequacy of Foreign Nationals in the United States. 325
Special Report No. 28. National Industrial Conference Board, New York. Pamphlet. $1. The immigration legislation recently enacted was greatly influenced by a report made by Dr. H. H. Laughlin for the House Committee on Immigration and Naturalization. The Conference Board's Research Staff has investigated this report to discover whether its findings are sufficiently accurate to justify the extent of its influence on the immigration legislation. The Research Staff found that Dr. Laughlin's conclusions and recommendations do not offer an adequate scientific basis for immigration policy since they are, essentially, the result of application to inadequate and unrepresentative data of controversial scientific theories untested by long experience and study.

Steadying the Workers' Income. 331.137
Margaret Gadsby. *Monthly Labor Review,* July 1924, v. 19, pp. 8-32. Report on insurance against unemployment, covering trade-union out-of-work benefits, and national and international union plans.

Textile Finishing Plants. 38(75)
R. G. Macy. MANAGEMENT AND ADMINISTRATION, Aug. 1924 v. 8, pp. 167-171. Illus. One of the articles on the industries in the South. Describes plants and process employed, including dyeing of textiles, etc.

Wages, Hours, and Employment of Railroad Workers. 331
Research Report No. 70. National Industrial Conference Board, New York. 80 pp. $2. Contains a report of a survey, conducted by the Conference Board, of wages, hours, and employment of railroad workers and their relation to railroad finances. Because wages are an important factor in railroad prosperity which, in turn, influences general business conditions; and because the purchasing power of so large a body of workers as the railroad employees is an important influence in general industrial activity this report is of considerable interest to industry. Briefly the reported trend of wages is: average hourly earnings of all railroad wage earners in first quarter of 1924 were 136 per cent greater than in 1914; average weekly earnings in 1924 were 99 per cent greater than in 1914; while the purchasing power of the weekly earnings or "real" earnings for 1924 were but 20 per cent greater than in 1914.

Wastage of Men. 331
Ethelbert Stewart. *Monthly Labor Review,* July 1914, v. 19, pp. 1-8. The wastage of man power is cause of industrial unrest and destructive of self respect of workmen. Discusses waste due to unemployment, labor turnover, plant inefficiency, and waste in agriculture.

The Working Value of the Economic Forecast. 338.97
Park Mathewson. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 181-183. Describes factors used in forecasting. Periodic losses largely avoidable.

Fuel

Coal Commission Report Analyzed. 662.65
F. G. Tryon and W. F. McKenney. *Black Diamond,* July 12, 1924, pp. 32-33; July 19, 1924, pp. 60-62, v. 73. Illus. Also reproduces some of the charts used.

The Coal Resources of the World. 662.65
Sir Richard Redmayne. *Colliery Guardian,* July 4, 1924, v. 128, pp. 23-24. Charts. Present and probable future conditions. Statistics compared, and exploitation of low-grade coal urged.

Combustion Control Based on CO_2 in Gas. 662.621
G. E. Gaster. *Power Plant Engineering,* July 15, 1924, v. 28, p. 769. Variation in CO_2 operates rheostat controlling speed of fan motor.

Eastern Bituminous Gas Coal as Water Gas Fuel. 662.65
George H. Smith. *Gas Age Record,* July 5, 1924, v. 54, pp. 3-6, 14. Illus. Experiment by the Central Hudson System to prove that economy may be obtained by the use of a good grade, well-sized, bituminous coal.

Engineers Advocate Summer Storage. 662.65
Black Diamond, July 12, 1924, v. 73, pp. 29-30. American Engineering Council suggests ways to eliminate coal shortage through seasonal storage.

Fuel Resources of Canada: Their Utilization for the Production of Power and Other Purposes. 662.6
B. F. Haanel. *The Engineering Journal,* July 1924, v. 7, pp. 361-382. Illus. Coal, peat, wood, oil, and gas, their production, preparation, and use in Canadian industries. Paper was read at the World Power Conference, London, July 1924.

Gas Furnace Installations. 662.76
H. R. Hems. *The Gas World,* June 14, 1924, v. 80, pp. 553-555. Some practical figures showing various uses of gas furnaces in the melting of metal, tube manufacture, sugar boiling, cyanide hardening, and enameling and lacquering.

The Industrial Gas Business. 662.76
W. D. Thompson. *American Gas Journal,* July 19, 1924, v. 121, pp. 667-668. Use of gas in welding furnaces, core ovens, rivet heaters, and forge and plate heating furnaces.

Lignite Coal and Its Utilization. 662.6
J. E. Babcock. *Black Diamond*, July 5, 1924, v. 73, pp. 4-5. Resources and future significance of lignite as a fuel.

Pulverized Fuel for Boilers. 662.65
W. M. Selvey. *Colliery Guardian*, June 11, 1924, v. 128, pp. 157-158. Discusses briefly types of fuel tests, specifications, preparation, burners, etc.

Seasonal Storage of Coal. 662.65
MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 197-199. Summary report of Storage of Coal Committee of American Engineering Council.

Selling Industrial Gas. 662.76
Ismar Ginsberg. *American Gas Journal*, July 26, 1924, v. 121, pp. 677-678, 691. Gas as a fuel from viewpoint of economy and efficiency of combustion.

Store Your Coal Now. 662.65
R B. Williams. *Cement, Mill and Quarry*, July 20, 1924, v. 25, pp. 33-35. Quotes prices of coal and methods of storing.

Use of Town Gas in Industry. 662.6
A. Duckham. *Iron and Coal Trade Review*, July 11, 1924, v. 109, p. 64. Gas versus coal as fuel. Cost of gas can and should be reduced. Burning of raw coal a waste.

Utilization of Peat for Power Production. 662.6
G. K. Fletcher. *World Power*, July 1924, v. 2, pp. 19-22. Difficulties encountered in the successful exploitation of peat. Discusses cost of extracting and transporting peat in relation to its fuel value.

Works Problems and Methods in Fuel Economy. 662.6
Sir R. Hadfield. *Iron and Coal Trades Review*, June 20, 1924, v. 108, pp. 1066-1067. Abstract of paper. Includes heat-treatment, and reheating furnaces, gas quality for steel heating, melting efficiency, etc.

Maintenance and Repair

The Disposition of Discarded Material. 658.58
H. C. Stevens. *Railway Review*, July 19, 1924, v. 75, pp. 87-91. Kinds of materials that may be reclaimed in railway shops. Work should be under supervision of a thorough, studious, and well-equipped man.

Factory and Plant Maintenance. 693.5
Article 26. Arnold A. Arnold. *Mechanical World*, July 11, 1924, v. 76, pp. 24-25. Use of concrete in construction and maintenance with notes on mixing and foundation work.

Gearing and Gear Lubricants. 621.89
A. F. Brewer. *Industrial Management*, July 1924, v. 68, pp. 18-24. Illus. Various types of industrial gears and means of lubrication.

Managing Maintenance Work with Economy. 658.58
Theodore Clark. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 191-196. Illus. Planning, routing and use of standard times in repair and construction work.

Prime Movers and Their Lubrication. 621.89
Power Plant Engineering, July 15, 1924, v. 28, pp. 739-742. Scientific application of lubricants.

A Simple and Economical Method of Handling Repairs. 658.58
Fred. H. Colvin. *American Machinist*, July 31, 1924, v. 61, pp. 189-190. Illus. Service order department run like a small, independent shop. Quick service with low overhead charges.

When Analyzing Coil Insulation Troubles. 658.581
H. L. Hazeltine. *Industrial Engineer*, July 1924, v. 82, pp. 333, 337, 354. Illus. Includes also treatment for enameled wire when used with and without cotton covering.

Management

Administration Control and Response. 658.1
W. E. Hotchkiss. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 173-175. Unity of management achieved through executive control and co-ordination of departments.

Applying the Budget System to Railroads. 658.14
H. Bruere and A. Lazarus. *Industrial Management*, July 1924, v. 68, pp. 35-46. Illus. A review of present practice and a forecast of future possibilities.

Budgeting Repair and Maintenance Expenses. 658.14
W. F. Woodbury. *Industrial Engineer*, July 1924, v. 82, pp. 312-316, 354. Illus., Charts. Details of a plan in operation in the plant of the Wahl pens and Eversharp pencils.

Capital Requirements for Manufacturing. 658.14
W. A. Layman. *Iron Age*, July 24, 1924, v. 114, pp. 210-212. Financial showing of thirteen companies. How money needs expand faster than increase in volume of sales. Statistical proof based on company records for 1922 and 1923.

Control of Functional Specialists. 658.1
W. E. Hotchkiss. *Society of Industrial Engineers' Bulletin*, June 1924, v. 6, pp. 4-5. Central control of special departments and their executives is necessary to keep the pace that makes maximum efficiency possible.

Fehlarbeit und Erfahrungsaustausch. 658
E. Springorum. *Maschinenbau*, June 12, 1924, v. 3, pp. 607-609. Need of management, production control, and waste elimination. Suggests experience conferences among executives as a means toward establishing maximum efficiency in German industries with the least loss of time.

Statistics as an Aid to Executive Control. 658.14
C. E. Stevens. *Society of Industrial Engineers' Bulletin*, June 1924, v. 6, pp. 7-8. Defines executive financial control and how to obtain it.

Management of Special Industries

Applying the Budget System to Railroads. 658.9:656.2
H. Bruere and A. Lazarus. *Industrial Management*, July 1924, v. 68, pp. 35-46. Illus. A review of present practice and a forecast of future possibilities.

Better Foundry Practice, No. 1. 658.9:621.72
Metropolitan Life Insurance Co., New York. Pamphlet. First of a series of descriptive studies of management practices in foundry work based on a study of 54 representative foundries. Treats of foundry location; building layouts for foundry departments, material storage, and precaution; building construction; lighting, heating, and ventilation.

Building a Car a Minute at Ford City. 658.9:629.113
Harold P. Armson. *Canadian Machinery*, June 26, 1924, v. 31, pp. 41-48, 80. Illus. History and organization of the 15-acre plant of the Ford Motor Co. Gives machine shop diagram and operation sequence.

Economy in Foundry Practice. 658.9:621.72
E. H. Browne. *Foundry Trade Journal*, July 10, 1924, v. 30, pp. 38-40. Recommendations regarding management, equipment, up-keep, and other points of foundry expenditure.

Ford's New $10,000,000 Factory. 658.9:629.113
Canadian Manufacturer, June 1924, v. 44, pp. 11-15. Illus. Layout of the plant, construction of buildings, and description of machine shop.

Graphic Control in a Small Hosiery Mill. 658.9:687.3
W. E. Haseltine. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 161-166. Charts. How charts are employed to give control of all the factors entering into operation. Methods described may be applicable in other industries.

Handling 42,000,000 Tons of Raw Material a Year. 658.9:666.9005
L. N. Duryea. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 155-160. Illus. Labor-saving devices and conveyor systems used in the manufacture of portland cement.

Machine Shop Problems in Making Tire Molds. 658.9:629.113
Harold P. Armson. *Canadian Machinery*, July 10, 1924, v. 32, pp. 19-21, 39. Illus., diagr. Turning molds to shape, engraving tread designs. Methods employed by the Potts Pattern and Machine Co.

Manufacturing a Popular Motorcycle. 658.9:629.1185
Engineering Production, July 1924, v. 7, pp. 208-213. Illus. Management and organization of Douglas Motors, Ltd.

Material-Handling Problems in Automobile Assembly. 658.9:629.113
M. R. Denison. *The Automotive Manufacturer*, June 1924, v. 66, pp. 24-26. (To

be continued). Time and labor saving methods used in Studebaker plant at South Bend. Makes reference to stores keeping and control.

Unit System for Freight Car Repairs. 658.9:625.2
J. M. McCleman. *Railway Mechanical Engineer*, July 1924, v. 98, pp. 419-420. Chart. Fixed applied piecework labor costs per car used as the basis of output in New York Central shops.

Material Control

From "Order Received" to Freight-Car Door. 658.78
Joseph M. Schappert. *Factory*, July 1924, v. 33, pp. 45-47, 141. Illus. Routine method employed by the Metal Stamping Company in checking orders and shipments.

How Simplified Practice Will Benefit Railways. 658.78
Ray M. Hudson. *Railway Age*, July 26, 1924, v. 77, pp. 155-156. Lowering costs by producing and purchasing a minimum variety of rail sections, gears, bars, and other materials.

Importing as a Science. 658.783
J. A. Dunnage. *Business Organization*, July 1924, v. 10, pp. 249-254. Emphasizes the need for firms to know the various means by which cargo is landed, warehoused, and cleared through the ports. Suggests some general principles.

Material-Handling Problems in Automobile Assembly. 658.78
M. R. Denison. *The Automotive Manufacturer*, June 1924, v. 66, pp. 24-26. (To be continued). Time and labor saving methods used in Studebaker plant at South Bend. Makes reference to stores keeping and control.

Oil Storage and Handling Practice. 658.78:665
Electric Railway Journal, July 19, 1924, v. 64, pp. 77-79. Illus. Describes methods of storage and oil houses. Recommends reclamation of lubricating oils.

Perpetual Inventory and Stores Control. 658.787
Department of Manufacture, Chamber of Commerce of the United States. Pamphlet. Contains 26 pages of condensed, practical information about methods of controlling inventory. Discusses organization, location and arrangement of stores, perpetual inventory, cost accounting, yearly closing, and similar subjects.

S. P. Houston Store Has Many Fine Features. 658.78
Railway Review, June 14, 1924, v. 74, pp. 1094-1103. Illus. Purchasing and stores department of the Southern Pacific Co. and practices followed in unit piling of materials, stores delivery, and supply train operation.

Seasonal Storage of Coal. 658.78:662.65
MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 197-199. Summary report of storage of Coal Committee of American Engineering Council.

Transportation of Material in the Roanoke Shops. 658.78
J. M. Thomas. *Railway Review*, June 14, 1924, v. 74, pp. 1126-1130. Illus. Delivery system of the shops of the Norfolk and Western Railway, traction trains and individual tractors follow definite schedule and route.

A Workable Production Control System. 658.78
Edward Davis. *American Machinist*, July 3, 1924, v. 61, pp. 7-10. Illus. Detailed description with office records of interdepartmental shipments. Bulk moved after working hours.

Mechanical Handling

The Electric Motor Truck. 656.124
By Edward E. La Schum, 307 pp. U. P. C. Book Co., New York. $4. The electric motor truck is becoming increasingly important in the transportation field, especially in services necessitating short hauls and frequent stops. This book, by the general superintendent, Motor Vehicle Equipment, of the American Express Company, covers the selection of motor vehicle equipment, its operation and maintenance. After a short history of motor truck development, electricity and magnetism is treated in a practical manner and in sufficient detail to make clear the principles underlying electric truck design and operation. Then comes a chapter on the construction of the truck, including frames, springs, drives, axles, steering gears, etc., followed by a chapter on the motive equipment. The various types of storage batteries and charging equipment are described and there is a chapter on proper cost finding methods for use on motor truck work.

Die Entwicklung der Förder-und Verladeanlagen zu groben Abmessungen und Leistungen. 658.281
G. v. Hanffstengel. *Maschinenbau*, May 22, 1924, v. 3, pp. 557-567. Development of mechanical conveying. Describes cranes, belts, aerial cables, etc.

Handling 42,000,000 Tons of Raw Material a Year. 658.281
L. N. Duryea. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 155-160. Illus. Labor-saving devices and conveyor systems used in the manufacture of portland cement.

Hauptschacht-Gefässförderungen. 622.6
L. Schütt. *Zeitschrift des Vereines Deutscher Ingenieure*, June 28, 1924, v. 68, pp. 665-671. Illus. Mine hoisting and transportation, describing cars, buckets and dumping devices.

Industrial Transportation Over Definite Lines of Travel. 658.281
M. W. Potts. *Industrial Management*, July 1924, v. 68, pp. 50-57. Illus. Advantages and limitations of the industrial railroad as a means for efficient handling of materials.

Die Lastaufnahmemittel der Krane. 658.281
R. Hänchen. *Maschinenbau*, May 22, 1924, v. 3, pp. 567-575. Cranes with various dumping contrivances described and illustrated.

Lumber Handling in an Automobile-Body Plant. 658.281
B. Nagelvoort and Thomas D. Perry. *Mechanical Engineering*, August 1924, v. 46, pp. 472-477. Illus., diagrs. Efficient and economical handling resulting from the use of lumber lifts, stackers, power transfer cars, and dry kiln trucks, transfer cars, and storage piles on wheels.

Material Handling as Our Key to Many Savings. 658.281
M. R. Denison. *Factory*, July 1924, v. 33, pp. 30-33, 62. Illus. Economies in labor, in inventory, and in floor space are the result of the methods in material handling in use at the Studebaker plant.

Normale Dampfkrane. 658.281
W. Benedict. *Maschinenbau*, May 22, 1924, v. 3, pp. 576-577. Construction and use of steam operated movable cranes.

Welche Förderbedingungen bestehen in den einzelnen Betrieben? 658.281
Maschinenbau, May 22, 1924, v. 3, p. 577. Conveying and types of conveyors, and general principles of suitability under specific conditions.

Wirtschaftlichkeit von Hausrohrpostanlagen. 621.548
J. Fritz. *Zeitschrift des Vereines Deutscher Ingenieure*, June 28, 1924, v. 68, pp. 681-683. Illus. Pneumatic mail tubes for plant and house use.

Office and Equipment

The Business Letter-Writer's Manual. 651.74
By Charles Edgar Buck, 232 pp. George H. Doran Co., New York. $2. Letter writing is an important part of the daily work performed in every business organization. The impression letters make upon their recipients is influenced, to a great extent, by the form of the letter as distinguished from its subject matter. A letter which is written in a straightforward manner avoiding hackneyed expressions, which is grammatical and couched in good English, and which is arranged to present a pleasing appearance, will receive more favorable attention by its recipient than one not so carefully prepared. This book contains much valuable information about letter writing which will be useful to every business man. Not only does it discuss make-up of letters, grammar, word usage, punctuation, and similar subjects, but considerable space is devoted to subject matter suitable for particular types such as credit and collection letters. Examples are used

extensively to illustrate the author's meaning.

Collection Letters. 651.75

R. M. Dulin, 95 pp. The Ronald Press Company, New York. $1.25. Consists of letters, with some introductory material and running comment, concerning that stage in the credit cycle when goods have been delivered and payment must be secured by application of whatever degree of pressure the circumstances seem to require. Numerous examples of letters are given ranging in forcefulness from a gentle reminder for use directly an account becomes overdue to the "attorney" letters which represent the collector's last stand before he has recourse to law. The book will be of considerable practical value to all who are concerned with credits and collections.

Correspondence Handling System Solved. 651.457

Howard Main. *Canadian Manufacturer*, June 1924, v. 44, pp. 30, 32-33. Mail distribution and automatic machines for opening and stamping.

Credit Letters. 651.74

By Robert M. Dulin, 84 pp. The Ronald Press Co., New York. $1.25. Effective correspondence is a dominant factor in successful credit work. Before any credit relation or rating can be established, detailed financial information, generally confidential in character, must be obtained from the customer. This is best accomplished by means of letters—friendly and diplomatic, but at the same time dignified and firm in tone. This book contains a collection of letters that have been used by various concerns and have been proved successful in actual credit work. They cover such subjects as requests for financial statements, general credit information, shipments held up, questions of discount, acknowledgement of orders, and similar subjects. It is a book of practical value to credit men.

Filing Methods. 651.5

By Eugenia Wallace, 107 pp. The Ronald Press Co., New York. $1.25. The task of filing letters, papers, etc., in such a way that they are instantly available when wanted is a very important part of the work carried on by every business concern. To those concerns who are unsatisfied with the results obtained from their present filing system, and to those who may be satisfied but are still seeking improvement, this book will be a source of valuable suggestions. The writer has had wide experience in filing work and her book is an authoritative treatment of the subject. The book is concise, very practical, and will be of great assistance to file clerks, secretaries, or others who include filing among their duties.

Labor-Saving Appliances in Accounting Work. 651.26

Railway Review, July 5, 1924, v. 75, pp. 1-7. Illus. Mechanical devices used in railway accounting departments.

Privacy or Prestige—or Work? 651

W. D. Bruner. *Business*, Aug. 1924, v. 5, pp. 20-21, 38. When and when not a private office is necessary. Should not be used merely to indicate rank of executive.

Report Writing. 651.78

By Ralph U. Fitting, 100 pp. The Ronald Press Company, New York. $1.25. Every business concern has, more or less frequently, to prepare reports for various purposes. Often, important decisions are based on these reports so that it is essential that they are prepared properly. This book is a concise but complete and authoritative manual on report writing. It discusses the different types of reports and the methods of procedure best adapted for each. Methods of investigation are described, including the determination of what information should be obtained, the proper method to gather it, and how it should be recorded. Logical formation and arrangement of the assembled data is then taken up, followed by an exposition of the actual writing of the report. To those who must prepare reports or who wish reports they receive to be prepared properly this volume will prove valuable.

Secretarial Duties and Traits. 651.3743

W. W. Charters and Isadore B. Whitley, 62 pp. Service Bulletin No. 1. National Junior Personnel Service, New York. Pamphlet. Summary report of an investigation to determine the duties performed by the secretary to business men, and the qualities that are conspicuously present in successful secretaries and conspicuously absent in unsuccessful ones. By interviews with 125 secretaries, 871 duties were collected and their frequency of performance checked by a questionnaire filled out by 715 secretaries. A list of 47 traits present in successful secretaries was obtained by interviews with employers. Results of the investigation are presented in tabular form with sufficient explanatory matter to make their interpretation easy. Information contained should be valuable to executives, secretaries, or stenographers.

Shortcuts to Efficiency in the Drafting Room. 621.75

G. A. Dembery. *Canadian Machinery*, July 10, 1924, v. 32, pp. 30-31. Elimination of unnecessary and complicated tools and processes produce greater efficiency.

Statistical Typewriting. 651.523

By E. H. Brown, 77 pp. The Ronald Press Co., New York. $1.25. Budgets, cost estimates, reports, and financial statements in any business are of the greatest possible value only when they are set forth in accordance with the best standards of statistical typewriting. In this book Mr. Brown shows what these standards are and gives detailed practical information regarding their application in daily work. It has genuine value for every stenographer or typist who sees the possibilities of expert tabulation as a path to more important work and better pay, and also for every executive or supervisor who needs a ready-to-use manual for the instruction of his stenographic force.

Personnel

Building the Morale of the Working Force. 658.3

J. H. Cummings. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 137-139. History of welfare work in the Stetson Hat Company which began in 1865, and now includes every feature designed to add to employee contentment.

Business Methods in Engineering. 658.315

J. T. Beard. *National Engineer*, July 1924, v. 28, pp. 303-305. Real service means cooperation among workers, and a willingness to meet every man halfway. The engineers' problem receives special attention.

Employment, Hours, and Earnings in Prosperity and Depression. 658.3137

Willford I. King, 147 pp. National Bureau of Economic Research, New York. $3.10 post paid. The conference on unemployment through its Committee on Unemployment and Business Cycles allotted to the National Bureau of Economic Research the task of supervising an investigation of actual employment conditions in the United States. This Bureau was chosen because of its suitability for fact-finding and also because all reports must be reviewed by a Board of Directors, representing widely divergent interests to safeguard against bias. This book is a summary of the results obtained from the investigation. The following items of information, of considerable value to American industrialists, are presented: the relative responsiveness of different industries to fluctuations of the business cycle; comparative ability of large and small businesses to resist such fluctuations; shifts of population among industrial fields; variations of hours and earnings that accompany change from boom to depression; nearly complete record of seasonal changes of employment in agriculture; distribution of farm employees according to hours and earnings; importance of part-time employment in industry; and the approximate effect on employment brought about by the depression of 1921.

The Engineer's Output and Income. 658.31243

O. H. Kneen. *Buildings*, June 25, 1924, v. 61, pp. 1403-1405. Some reflections on the individual's output and its relation to income with special reference to the draftsman.

Giving Labor Product of Its Toil. 658.31

A. J. Thompson. *Iron Trade Review*, July 10, 1924, v. 75, pp. 99-101. Chart. Discusses the employee's relation to the product he helps to create and his share in its market value.

Hiring the Right Man for the Job Advertised. 658.31155

Russell J. Waldo. *Canadian Machinery*, July 3, 1924, v. 31, pp. 24-25, July 17, 1924, v. 32, pp. 25-26. Importance of tests in ascertaining ability of job-seekers, and job specification forms used by the Studebaker Co. Ability tests for machine operators and repair men.

How We Get Uniform Output from Widely Separated Plants. 658.5
P. W. Litchfield. *Factory*, July 1924, v. 33, pp. 23-25, 116. An interplant relations department makes possible the contact work between plants for the Goodyear Tire and Rubber Company.

Indicts Faulty Shop Lighting. 628.9
Michigan Manufacturer and Financial Record. July 5, 1924, v. 34, pp. 5, 27. Points out the need for better lighting, not only in the factory, but also in the home and in the schoolroom. Urges examination of children's eyes.

Linking the Shop to the Office. 658.315
Charles R. Hook. *Open Shop Review*, July 1924, v. 21, pp. 241-252. How the American Rolling Mill Company created a spirit of goodwill and understanding.

Das Literarische Büro einer Maschinenfabrik. 658.385
F. Runkel. *Maschinenbau*, June 12, 1924, v. 3, pp. 626-628. Suggests a department for distributing catalogs, technical magazines, house organs, to employees in every plant and taking care of lecture courses, etc.

Maintenance Department in Industrial Safety. 658.3823
H. W. Donald. *Industrial Engineer*, July 1924, v. 82, pp. 321-325. Illus. Precautions men can take to protect themselves, and methods by which they can reduce the cost of accidents.

Organization Vital in Successful Manufacture. 658.315
Stanley H. Bullard. *Canadian Machinery*, June 26, 1924, v. 31, pp. 57-59. Diagr. A co-operative organization with inter-related departments, and policies known to all employees, the keynote of success of the Bullard Machine Tool Co.

Organizing the Personnel for Production. 658.3
G. D. Babcock. MANAGEMENT AND ADMINISTRATION, Aug. 1924, v. 8, pp. 141-146. Illus. Charts. How the Holt Company introduced the four Taylor principles of scientific management.

Pitfalls of the Employment Interview. 658.3115
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T. N. Beckman. 465 pp. McGraw-Hill Book Co., New York. $4. The aim in writing this book has been to cover the entire field of credits and collections, both foreign and domestic, and to provide exact, definite, and practical information on all phases of the subject. Contents are divided into 4 main parts: fundamental principles of credits and collections; sources of credit information; credit department organization and management; and technical and legal aspects of collections. The subject is thoroughly discussed and is illustrated by the use of numerous forms and tables. An appendix gives terms of sale customarily used in various lines of trade.

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CONDITIONS AND PROSPECTS
IN
BUSINESS AND INDUSTRY

Better Business Forecast Strengthened

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During August the P/V line, shown in Fig. 1, made a further good rise, although the percentage of change was not quite so great as in July. The main forecasting line is now at a higher level than any reached since July 1923. The continued rise of the P/V line, together with other favorable indications discussed below, warrants the conclusion that business will continue to improve for a period of at least six months.

It should be noted that volume has now begun to rise as well as price—a clear indication that the actual improvement in business which has been forecast is now at hand. Increasing total volume at higher prices means better net earnings to come.

Probably the outstanding conclusion to be drawn from the data covering industry in August and early September is that recovery from bottom levels has actually begun in a number of important cases. In all respects, the reasoning in last month's discussion to the effect that the bottom of a major depression had been reached and that a major upturn was in the making, has been confirmed by August data. Increased production in iron and steel, increased cotton consumption, increased coal output, increased railway tonnage, increased bank debits—all mark the turn. The conclusive evidence is given by a rise in Bradstreet's price index, which for the two months of July and August totals 4.7 per cent.

Recent Developments

Among the salient industrial developments of August and the early part of September were the following:

1. Unfilled steel orders reversed their downward trend and increased decidedly, indicating a gain in forward buying (Fig. 3).
2. Production of bituminous coal increased, after eliminating normal seasonal variation (Fig. 5).
3. Employment of labor appears to have touched bottom and to have shown some increase during August. Per capita earnings also showed a stronger basis for purchasing power (Figs. 7 and 8).
4. Bank debits showed a decided increase which was emphasized by the fact that they usually decrease in August. The average weekly volume of checks drawn against individual accounts was far greater than in any recent year (Fig. 10).
5. Wholesale trade has shown an upward tendency.
6. The textile industry is in a much stronger position than it was a few weeks ago, with raw cotton cheaper and prices of finished goods holding relatively firm.
7. The London agreement has been ratified and, with the Dawes plan in operation, the beginning of an increased extension of foreign credits is probable. Net gold imports have further decreased.

Favorable Factors

Points which appear to be constructive in the most active way, without regard to how recently they occurred, are:

1. Money rates continue at bottom levels, while prices of commodities continue to move up (Fig. 12).

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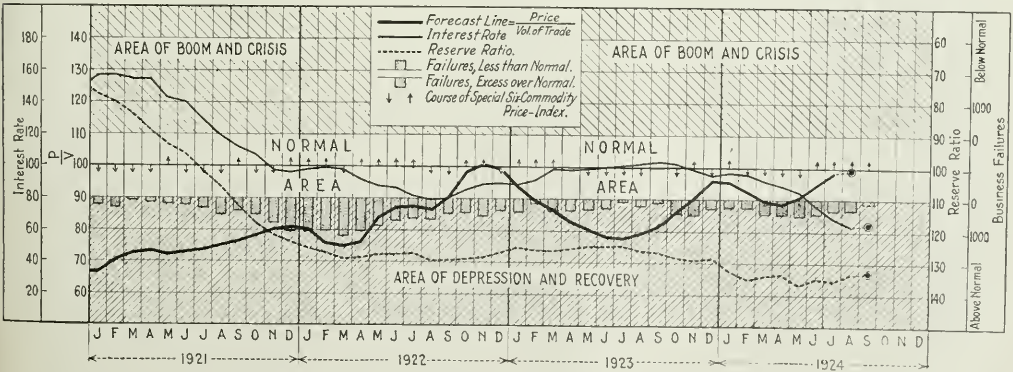
[1] Assisted by Horace J. Barney, R. H. Leding and Harry Corash, of the Bureau's Staff.



Data on the compilation of this curve can be obtained upon request to the editors. September data are estimates.

Fig. 1 The Barometer of Industry and Trade

2. Commodity stocks in general show a further decrease (Table 1).
3. Forward buying shows a small increase as indicated by the upward trend of unfilled orders and improved wholesale trade.
4. Employment of labor increased in August, which holds out hope that purchasing power may soon improve (Fig. 8).
5. Business failures decreased (Fig. 13).
6. Europe is in a better position to buy American products, and the export demand for wheat, cotton, and petroleum products has gained. Exports increased in August, even after allowance for seasonal variation.
7. In spite of extraordinarily heavy grain movement, corn and wheat prices have held a large part of their gains.

UNFAVORABLE FACTORS

1. Mail order sales continued to decrease, and, in general, the volume of retail sales may be said to have been disappointing (Fig. 11). In this connection attention is called to the decline in post office receipts. (Fig. 10).
2. Building activity continues at a relatively low level, although it seems more than probable that the bottom has been reached (Fig. 6).
3. Stocks of certain important commodities increased further or continued unduly large — notably gasoline and merchant pig iron (See Table 1).

FUTURE DANGERS

While it is thus apparent that on the basis of current industrial developments the general outlook appears decidedly favorable, it remains to be noted that a number of potentially unfavorable developments cast some shadows on the business future.

1. Possibility of the election of an increased radical element in Congress remains a threat of future unsound legislation. (It is believed, however, that the general lack of interest in the coming election indicates the common belief that Mr. Coolidge will succeed himself as President).
2. Gold inflation appears to have made some headway and the possibility of credit inflation is a serious consideration.
3. The great post-war readjustment of world industry and finance lies ahead. European competition is bound to grow in intensity during the coming year and American industry will be handicapped in meeting such competition by the existing high level of costs, notably labor costs.
4. In the course of time there is likely to be a withdrawal of funds from the United States which will tend to bring our period of easy money to an end.
5. Not a few great American industries have a capacity in excess of the probable future domestic demand, which suggests the danger that the industries affected by overcapacity may easily run into overproduction. It is to be noted that the steel industry, when running at only 55 per cent of present capacity, gives an output which is a little over that of 1913.

While an upturn in business may now be said to be an accomplished fact, there is much doubt as to the duration and extent of that upturn. This doubt is accurately reflected in the recent history of the stock market. The average of 50 stocks reached a maximum in the week of August 18, since when the average has by the middle of September declined nearly 4 points, and the volume of trading has fallen off notably. The stock market had discounted the upturn in business, but was not prepared to discount a boom.

It may be helpful to consider some of the possibilities for 1925. If our monetary and foreign trade circumstances were normal, we would have a gradual and irregular gain in business for several months, followed by a more rapid upswing and reaching a peak in the early summer of 1926, or thereabouts.

Two sets of facts, however, complicate the normal trend. On the one hand, the monetary situation suggests inflation; on the other hand, the world readjustment in industry suggests a very limited possibility for expansion. If inflation gains headway, we are likely to have an earlier and sharper gain in business with a higher peak and a severer crisis. If our overcapacity meets effective foreign competition, we are likely to see the normal upswing of business curtailed.

As to inflation, it may be said that there has been a considerable expansion of bank credit, notably in New York. Loans and discounts of member banks, which reached a minimum in the middle of 1922, are now higher than at any time since March 1921. In the week ended September 3, the loans and discounts on stocks and bonds increased 80 million dollars and were 711 million dollars over the same period in 1923. Demand deposits are at a high level. The advance in commodity and security prices *may* indicate the beginning of inflation. Certainly the stock market has suggested it strongly. With call loans at 2 per cent or less, and with commercial paper at 3¼ per cent, in spite of heavy crop movements and reviving fall trade, the fact that "money is cheap" is emphasized.

The loans being made to Europe will for some time largely represent credit and will probably not reduce our gold supply. Rather they will increase our exports and help put our prices up.

The federal reserve system has some power, through raising its discount rates and through releasing its large holdings of securities, to check inflation. The great danger is that our plethora of funds will prevent the checking of credit expansion by high interest and discount rates. We start the present upswing with a high reserve ratio and large loans and discounts.

As to what has been called a world readjustment in industry and finance, we repeat our reference to the overcapacity of basic American industries and call attention to the signs which have already appeared of increased competition from the German iron and steel industry. In this country we are in danger of attempting to maintain a happy industrial hunting ground by building a wall of tariff and immigration restrictions around ourselves and seeking to maintain high wages by means of inflated prices. This tendency was supported for a time by the abnormal demand for building construction and automobiles which followed the war. That demand is now largely satisfied.

European recovery will be slower than some writers seem to think. Moreover, the gold inflow has already been checked and more stable foreign exchange rates exist. These things will make the readjustment less violent and may postpone it until 1926. We are still lending money to Europe, which enables us to maintain an export balance; but some readjustment there must be.

It is too soon to forecast 1925, but improving business seems probable for the first six months of that year. Whether the collapse will come toward the end of 1925, or will be postponed until 1926, no one can say. The situation is highly complex and uncertain. This very fact will act as a drag upon business recovery. The wisest policy for most business men will be to figure on a gradual improvement during the next six or eight months and to watch for accumulation of commodity stocks and any tendency for money rates to become tight, as warning symptoms.

Production and Stocks of Commodities

Production Bottom Reached: Stocks Being Liquidated

Stocks of Commodities

As shown in Table 1 stocks of basic commodities have, on the whole, decreased. The Department of Commerce's index of 45 commodities declined 1½ per cent in July. The latest data show notable declines in stocks of pneumatic tires, zinc, newsprint paper, merchant pig iron and leather. On the other hand, stocks of gasoline and raw sugar (at refineries), continued upward during the month of August.

Production and Railway Tonnage

Fig. 2 shows that the downward trend of production and tonnage has been checked.

Railway Tonnage. After a good increase in the adjusted index of railway tonnage during July, the index dropped back a little in August, but held most of the July gain. The estimated tonnage hauled by Class 1 railways in August was 115.6 per cent of the 1921 average.

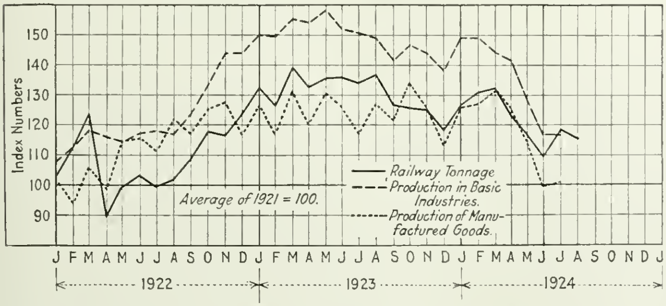
Production. Production in basic industries is apparently at the bottom and the adjusted index in July held steady at 116.9 per cent of the 1921 average. Manufacturing production (unadjusted) increased slightly in July and was about equal to the 1921 average.

Conclusion. Production in manufacturing industries has reached a very low level. Apparently all the curves in Fig. 2 have touched bottom. Liquidation in stocks of basic commodities in first-hands has made considerable progress. This is seen in the fact that the railway traffic curve has risen above the production curves. The large spread between production and traffic which existed in the early part of 1924 has disappeared. This is one of the most significant and favorable developments of recent months.

Iron and Steel Production

Production. August witnessed an upward turn in pig iron and steel ingot production, the indexes showing increases in the average daily rate of 3.9 per cent and 36 per cent respectively. (See Fig. 3).

Unfilled Orders. Unfilled orders of the United States Steel Corporation increased 102,500 tons after a five months' period during which the decline exceeded 1,700,000 tons.



Sources, Federal Reserve Board; N. Y. U. Bureau of Business Research. Railway tonnage and production in basic industries corrected for seasonal variation, and the latter also for normal growth.

FIG. 2 RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

Prices. Pig iron prices continue firm, while steel prices still show a tendency to be weak. According to the *Iron Age* composite prices, pig iron increased from $19.38 to $19.46 during the month, while steel prices declined from 2.517 cents to 2.481 cents per lb.

Conclusion. Whether prices are high or low, strong or weak, does not so much depend upon what they have been, but rather upon the attitude of those whose purchases create activity.

Although pig iron prices have held firm and in some cases increased, they have failed to bring forth much forward buying. A similar condition prevails in finished steel.

After a long period of declining prices, however, this lack of confidence is not surprising, and confidence will not be restored until the business man sees definite evidence of an upturn, in the form of greater demand for his products. Improvement will be gradual with a tendency toward irregularity.

From a price standpoint, we believe it would be wise to cover requirements of pig iron for the balance of 1924. On the other hand, certain finished steels, as a result of slackening demand, will probably continue easy during the next month.

Production in Important Industries

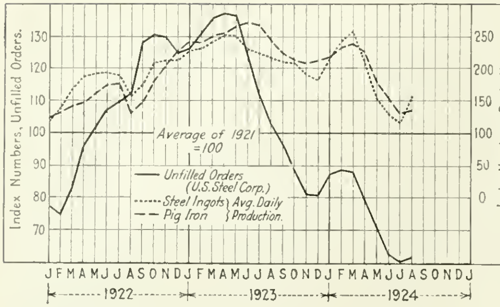
Copper. Figures on copper have been discontinued by trade sources. If not furnished next month, they will be replaced by other important data.

Paper. The production of paper, all grades, decreased more than usual in July, and the adjusted index now equals

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH

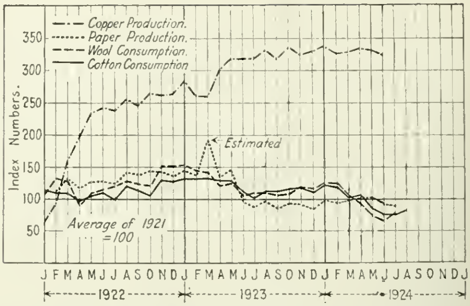
Average for 1921 = 100. Gasoline, raw sugar, cottonseed oil and Dept. of Commerce index adjusted for seasonal variation.

MONTH AND YEAR	GASOLINE	LEATHER (Cattle)	ZINC	NEWSPRINT PAPER	AUTOMOBILE TIRES	RAW SUGAR	COTTONSEED OIL	MERCHANT PIG IRON	DEPT. OF COM. INDEX OF STOCKS—45 COMMODITIES
	100 = 630,757,000 gals.	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,000 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.	100 = 634,950 tons	100 = 132
Jan. 1923	156	85.3	23.6	64.0	105.4	55.0	52.0	35.8	87.7
Feb.	156	84.0	21.5	76.7	107.6	76.0	60.0	43.0	84.1
Mar.	154	82.6	14.1	77.3	119.7	86.0	64.5	44.0	84.8
Apr.	162	81.6	13.0	67.2	129.9	168.0	67.0	38.0	84.8
May	164	81.4	11.6	62.9	139.3	147.0	69.0	41.7	80.4
June	173	82.1	16.9	60.5	159.6	97.0	71.0	53.6	83.3
July	174	82.8	22.2	65.0	161.4	97.0	76.0	72.7	82 6
Aug.	185	83.6	27.5	74.0	148.0	96.2	74.0	97.5	90.6
Sept.	199	84.3	34.4	85.5	138.5	81.8	57.4	111.0	95.5
Oct.	206	84.2	29.6	82.2	123.2	130.4	28.0	121.7	85.5
Nov.	211	85.4	33.4	82.4	111.7	102.8	43.0	131.0	88.4
Dec.	202	85.8	40.3	80.0	107.5	89.8	43.3	141.0	90.6
Jan. 1924	186	87.0	47.3	78.8	99.0	79.0	52.5	145.0	98.6
Feb.	187.5	79.5	52.7	94.6	110.0	54.5	53.5	144.5	97.8
Mar.	188	83.8	48.0	101.0	120.5	90.0	58.5	140.0	98.6
Apr.	203	81.2	41.5	103.0	132.0	143.0	60.2	139.5	98.6
May	197	77.2	42.5	105.6	141.3	125.6	63.2	148.6	102.9
June	214	78.0	54.9	114.9	140.1	99.1	62.4	158.8	95.7
July	220	77 0	64.3	111.4	141.1	108.9	68.2	164.2	94.3
Aug.	232.5	75.0	68.3	94.8	117.7	169.7	....	165.6	.....
Sept.	...	.....	66.0	....	.....	.....	...	157.2	.....



Sources, Iron Age; American Iron and Steel Institute. All curves corrected for seasonal variation.

Fig. 3 Iron and Steel Production and Unfilled Orders



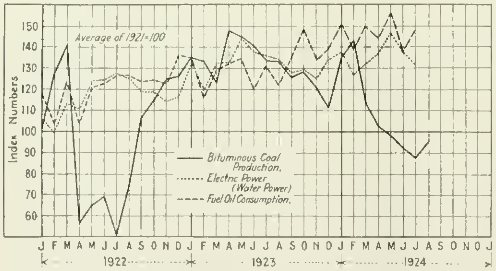
Sources, American Bureau of Metal Statistics; American Paper and Pulp Association; Bureau of Census; Department of Commerce. Cotton and wool curves corrected for seasonal variation.

Fig. 4 Production in Four Important Industries

89.8 per cent of the 1921 average. As newsprint paper stocks have decreased, the statistical situation in paper shows improvement.

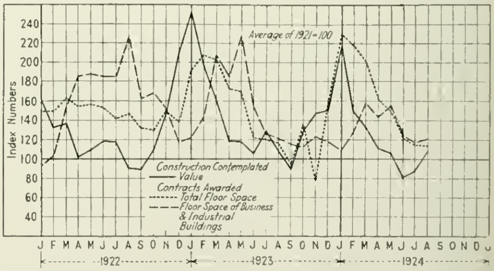
Wool. Wool consumption in July also increased, indicating a revival of activity in woolen textiles.

Cotton. Cotton consumption increased in August. (See Fig. 4). As August consumption usually declines, the gain is marked, and our adjusted index stands at 81 per cent of the 1921 level, against only 75.4 per cent in July—a rise of 7.5 per cent. There were more active spindles and smaller mill stocks of raw cotton. As soon as raw cotton prices are stabilized, a marked improvement is forecast in cotton textiles.



Sources, Department of Interior; Bureau of Mines; United States Geological Survey. Bituminous coal and electric power curves corrected for seasonal variation.

Fig. 5 Fuel and Power Production



Source, F. W. Dodge Company. Construction contemplated and total floor space curves corrected for seasonal variation.

Fig. 6 Building Construction and Floor Space in Contracts Awarded

Fuel and Power

The curves of fuel and power consumption shown in Fig. 5 suggest an increase in productive activity.

Bituminous Coal. One of the most notable points concerning August was the increase in coal production. Even after allowing for an upward seasonal variation of 8 per cent, the adjusted index moved up from 88 to 96, but this is lower than the 1921 average.

Hydroelectric Power. The index of hydroelectric power production for July moved downward. It is now lower than the figure for July 1923.

Fuel Oil Consumption. In July the indicated consumption of fuel and gas oils showed a sharp jump, rising from an index of 138 in June to 148. The fuel oil situation is stronger, with firmer prices likely.

Conclusion. The most notable fact concerning the fuel and power group is the upturn in bituminous coal. The coal curve should now rise toward the level of the other two shown in Fig. 5. At this time both cyclical and seasonal forces come together and promise increased coal output and higher coal prices. It seems clear that the soft coal industry has touched and passed the bottom of the depression. The composite bituminous coal price index of the *Coal Age* has advanced.

Building Activity in August

There is but little change in building activity shown in Fig. 6.

Contemplated Construction. During August the value of contemplated construction increased rather sharply, but the increase was due to one large public utility project in the Middle West and, therefore, does not appear to have much industrial significance. The chief fact is that the volume of deferred projects continues abnormally small.

Contracts Awarded. The total floor space in building contracts actually awarded, after adjustment for seasonal variation, decreased slightly in August. The index is the lowest for any August since 1921. Indications suggest that the bottom has been reached, but considerable residential building remains to be done in the smaller cities.

The (unadjusted) index of business and industrial building construction increased slightly in August. It still remains probable that the best chance for improvement in building activity lies in this field.

Conclusion. The course of building activity seems to have reached bottom levels. It will undoubtedly continue low throughout the remainder of the year on account of the small amount of deferred construction.

Wage and Employment Situation

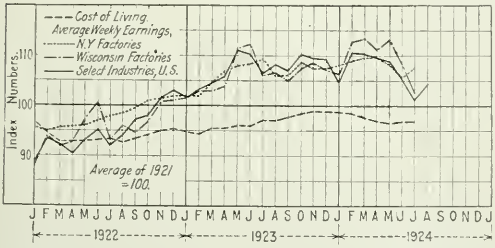
Employment Increases: Decline of Earnings Checked

Earnings and Cost of Living

Selected Industries in the United States. The index of per capita earnings, unadjusted for seasonal changes, increased 3.5 per cent in August. This followed a drop of 4.2 per cent in July. (See Fig. 7).

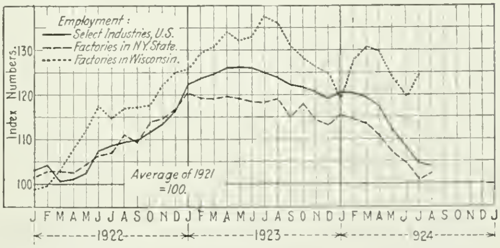
New York State. The adjusted index dropped in August to 107. Actual weekly earnings rose from $27.12 to $27.40, less than a normal increase.

Wisconsin. In July earnings fell, the seasonally corrected index dropping from 108.4 to 102.5. (The average during 1921 equals 100). It is probable that August reports will show an improvement.



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin; National Industrial Conference Board. New York and Wisconsin curves corrected for seasonal variation.

FIG. 7 WAGES AND COST OF LIVING



Sources, U. S. Bureau of Lobor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin. All curves corrected for seasonal variation.

FIG. 8 TREND OF EMPLOYMENT

Other States. Per capita earnings in Pennsylvania rose 6.1 per cent from July to August, and in New Jersey the increase was 0.7 per cent. These figures do not allow for normal seasonal changes.

Cost of Living. The index, as reported by the National Industrial Conference Board, showed no change in July, remaining at 96.9 per cent of the 1921 average.

Conclusion. The latest reports indicate higher per capita earnings, while at the same time labor's cost of living continues at a point about 3 per cent below the 1921 level. The buying power of industrial workers is now more favorable as a factor in estimating future business.

The Employment Trend

United States. The adjusted index of employment dropped slightly in August, following a sharp decline in July. It now stands at 103.9, compared with 104.6 in July, 108.0 in June, 120.6 in January and February, and 126.1 in May 1923—the high point of the present swing. Actual figures showed an increase of 0.2 per cent in numbers employed in August, which was slightly less than the normal increase for this month. (See Fig. 8).

New York State. After going down continuously since February the seasonally adjusted index of factory employment in this state increased 1.4 per cent in August. The only important decreases were in the manufacture of building materials, which until now have been holding up well. In New York City alone employment fell off in August. This was due to slowness in the seasonal revival in the women's clothing industry.

Wisconsin. In July the index of employment increased from 119.7 to 124.6 after adjustment for usual monthly changes. (The average during 1921 equals 100.) This was due to a large increase in numbers employed in the canning and preserving industries.

Other States. In Pennsylvania employment increased 1.4 per cent from July to August, due largely to heavy gains in carpet and rug factories. In New Jersey there was an increase of 1.1 per cent in numbers employed, due largely to a reopening of boot and shoe factories following July closing for inventory and repairs.

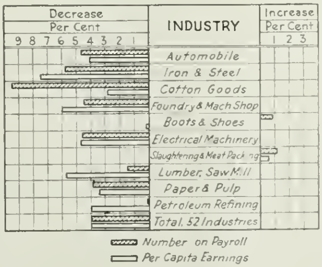


FIG. 9 TREND OF EMPLOYMENT AND EARNINGS, JULY 1924

Conclusion. All reports indicate or suggest increasing employment. August returns for New York State showed an increase in the seasonally adjusted index, for New Jersey and Pennsylvania increases in actual numbers employed, and for the United States a slight increase in actual employment but a small decrease in the adjusted index.

Employment and Earnings in Selected industries

The course of employment and earnings of 10 leading industries in July is shown in Fig. 9.

Employment. Further decreases in employment occurred in 8 of the industries analyzed. The average decline of 52 industries was 4.0 per cent. Cotton manufacturing led the decreases with a drop of 9.5 per cent. Boots and shoes, and slaughtering and meat packing, for the second consecutive month showed slight increases in numbers employed.

Per Capita Earnings. In all but one of the industries considered there were decreases ranging from 0.2 per cent in boots and shoes to 7.5 per cent in iron and steel. For slaughtering and meat packing a slight increase occurred in both earnings and employment. In the 52 industries combined there was an average decrease of 4.0 per cent.

Immigration and Emigration

The latest month for which figures are available is June. In that month there was an increase in both immigration and emigration, the latter reaching the highest point so far in 1924. The actual figures follow:

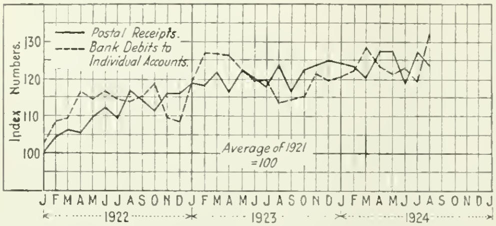
Date	Immigrants	Emigrants	Net Gain
June 1924	36,309	6,831	29,478
May 1924	32,985	6,634	26,351
June 1923	44,166	5,414	38,725

Trend of Trade and Finance

Wholesale Trade Increases: Money Easy and Prices Rising

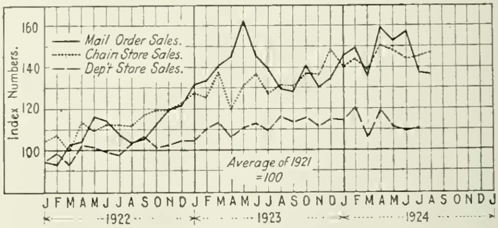
Bank Debits and Postal Receipts

Bank Debits. During August the weekly average in the volume of checks drawn on individual accounts was nearly 9.2 billion dollars against 7.8 billion dollars in 1923, and 7.9 billion dollars in 1922. The August figure was but little under July, although usually there is a sharp decline between the two months. Accordingly, the adjusted index increased from 120 to 132. (See Fig. 10).



Sources, Federal Reserve Board; Post Office Department. Both curves corrected for seasonal variation.

FIG. 10 BANK DEBITS AND POSTAL RECEIPTS



Sources, Commercial and Financial Chronicle; Federal Reserve Board. Data cover 2 mail order houses, 4 chain stores, and 306 department stores. All corrected for seasonal variation.

FIG. 11 SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES

Postal Receipts. The adjusted index decreased 3 per cent in August, but August had only 26 working days.

Conclusion. Increased bank debits show better wholesale trade. Probably postal receipts reflect retail sales, which are not so strong. The gain in bank debits may represent greater speculation, but the main cause is a revival of business.

Retail Trade

Mail Order Sales. The adjusted index of mail order sales shows a further slight decline for August, although dollar sales increased. The situation is not clearcut. The sales of one company indicated an increase of 22.6 per cent over August 1923, while the other company showed a decrease of 3.1 per cent. (See Fig. 11).

Chain Store Sales. The four principal chain stores showed increased sales for August that were slightly greater than is normal for the month.

Department Stores. The index of department store sales, after correction for seasonal variation, increased slightly during July. So far there have been no signs of radical recession.

Conclusion. While the trend of retail trade in general was downward during May, June, and July, the level was somewhat higher than in 1923. Indications suggest improvement this fall.

Prices and Interest Rate

Prices. Bradstreet's index of commodity prices advanced 1.4 per cent during August. The two months of July and August together showed a gain of about 4.7 per cent. See Fig. 12.

The Bureau's six-commodity index increased 4.8 per cent in August. So large an advance would hardly occur except in a business cycle upswing.

Interest Rate. The rate on commercial paper continued to decrease throughout most of August and the adjusted index fell to 48.2 per cent of the 1921 average. The New York rate on best commercial paper averaged 3.13 per cent against 3.37 per cent in July.

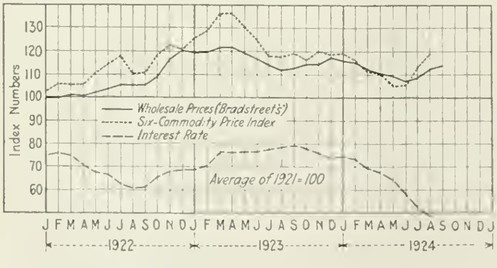
Conclusion. Prices will probably rise and money rates will undoubtedly hold low during the remainder of the year, when an upturn is probable.

New Enterprises and Failures

Business Failures. The decrease of business failures during August was only about the same as the usual seasonal variation and the adjusted index remains practically unchanged. The three-months' moving average, shown in Fig. 13, continued downward and the general trend appears to be favorable.

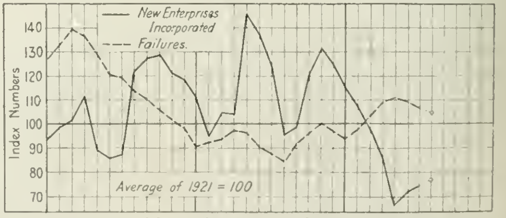
New Enterprises. There was a decrease in new enterprises during August which was greater than usual, and the adjusted index fell from 85 to 77. It is still, however, above the indexes for April, May, and June. The increased number of new oil and gas companies was notable.

Conclusion. While the trend of failures and new enterprises is not so strongly suggestive of further gains as was the case in July, the general trend continues to indicate that a recovery in business is well under way.



Sources, Commercial and Financial Chronicle; Bradstreets. Interest rate is the monthly average, corrected for seasonal variation.

FIG. 12 WHOLESALE PRICES AND INTEREST RATE



Sources, Dun's Review; New York Journal of Commerce. Both curves plotted as a 3 months' moving average, centered and corrected for seasonal variation.

FIG. 13 NEW ENTERPRISES AND BUSINESS FAILURES

MANAGEMENT
AND
ADMINISTRATION

VOLUME VIII OCTOBER, 1924 NUMBER 4

Working Plans to Realize Profits

Navigating a Business—I

By G. CHARTER HARRISON

Consultant in Management

Index Number
658 Industrial management

THE ship is a symbol dear to the hearts of men. There is so much in common between them that little imaginative effort is required to see the resemblance between the voyage of a ship, the life of a man, and the course of a business venture—they all have their fair days and their foul—the winds that help and those that hinder. How obvious, for instance, the analogy between the well-manned ship forging ahead to some happy destination and the well-organized successful business, and in contrast, the analogy between the abandoned ship left to the mercy of the tides and the neglected business drifting along until ultimately it meets its doom on the rocks of bankruptcy.

Many are the hazards to be met before a ship can arrive at its destination—many indeed are the risks faced by a business before it arrives at the port of substantial profits. And many a business ship never arrives in this fair haven at all.

Navigation, which is defined as being the science or art of conducting a ship across the seas, is a comparatively recent development. Even so late as the fifteenth century, navigation, as one writer puts it, "was conducted in the most rude, uncertain, and dangerous manner it is possible to conceive". At the time of Columbus it was the custom to guess or estimate the rate of progress made by the ship; these guesses were made every two hours or so and were used as a basis upon which to figure the position of the ship. Quite often, as was to be expected, the guesses were considerably off, with the natural result that wrecks were by no means infrequent. Even in the latter part of the seventeenth century so seafaring a race as that of Britain sustained an extraordinary number of naval casualties owing to faulty navigation:

> . . . Several men-of-war off Plymouth in 1691 were wrecked through mistaking the Deadman for Berry Head. Admiral Wheeler's squadron in 1694, leaving the Mediterranean, ran on Gibraltar when they thought that they had passed the strait. Sir Cloudesley Shovel's squadron in 1707 was lost on the rocks off Scilly by erring in their latitude. Several transports in 1711 were lost near the St. Lawrence, having erred 15 leagues in the reckoning during twenty-four hours.

Despite the great increase in the number, the size, and the speed of ships, maritime disasters, however, are today comparatively rare. This condition has been rendered possible by the development of the art of navigation.

Business disasters, however, are unfortunately a common occurrence, which condition is due, in the main, to defective business navigation. It is no exaggeration to apply to the conduct of many a business of today, the words about the state of ocean navigation in the fifteenth century:

> Navigation is conducted in the most rude, uncertain, and dangerous manner it is possible to conceive.

The principles of ocean navigation are well summarized in the following statement made by one who is an authority on the subject:

> In planning out in advance a long ocean voyage the experienced navigator would first, by laying down the track from port to port on a great circle chart, ascertain the shortest route between them. On examining such a chart in conjunction with the wind and current charts it will be seen what modifications the intervention of land, unfavorable currents or winds, ice or unduly high latitude, render necessary, and such modified route will finally be adopted subject to possible changes as the voyage progresses.
>
> Having thus planned the most desirable general track to pursue, three methods are employed to ascertain the position of the ship at any time during the voyage; these are (1) projecting the track on charts; (2) simple trigonometrical calculations where the data are the course steered and the distance run, and (3) astronomical observations, which form an entirely independent method.

Briefly summarized, therefore, the art of navigation consists, firstly, in laying out a course which will enable the ship to arrive at the desired port in the minimum time consistent with safety; and secondly, in providing for the constant determination of the ship's position throughout the voyage and its relation to the course laid down. This procedure is clearly illustrated by the North Atlantic Ocean navigation chart shown in Fig. 1, the solid line representing the course laid down for summer travel in an easterly direction between New York and Plymouth. The solid dots on this line indicate the estimated position of the ship each day at noon, and the small open circles the actual position of the ship as ascertained by the noon observations. By comparing his actual position and course with that laid down on the chart the navigator is able to make the necessary corrections in his course.

There are, of course, limitations to the power of navigation to avert disaster—the ship may not be stout enough to withstand the tempest—some unforeseen accident to the machinery may render the mariner helpless to keep his vessel from drifting on the rocks—but, nevertheless, due to good navigation the passenger on an ocean liner today is as safe as he would be by his own fireside. It is the same with business navigation: the business ship may not be staunch enough to withstand the storms it will have to meet—in some cases it was doomed to disaster before it ever left the dock but nevertheless good navigation will enable the industrial pilot to save his vessel from all disasters which are of a preventable nature.

Insolvencies Mainly Due to Poor Business Navigation

Business failures may be divided into two classes: (1) those due to causes for which the management should be held responsible, and (2) failures due to causes over which the management can exercise little or no control. In this second class are included what are legally known as "Acts of God," such as storms, floods, and other disasters which could not be foreseen by human ability, and such catastrophes as the unexpected failure of a large debtor. About 80 per cent of all the failures belong to the first class, and only 20 per cent to the second—in other words 80 per cent of all failures may be regarded as being due to faulty business navigation.

It has been estimated that more than one-third of the insolvencies in the United States have been due to "lack of capital," but as William H. Lough points out in his book "Business Finance," this rather vague term should probably be interpreted to mean "lack of working capital," which condition usually results from overexpansion and the tying-up of too great a proportion of the resources of the business in fixed assets. Mr. Lough summarizes the situation in these words: "If we were able to call the basic trouble in such cases 'mismanagement of capital' we should not be far from wrong," so that we may conclude that insolvencies classified as being due to "lack of capital" are really failures resulting from poor business navigation.

But failure is merely a relative term. A business may escape actual insolvency and yet be a failure if its management is not able to conduct its affairs in such a way as to realize a full return from the money invested in the business—this is the kind of failure described in the Parable of the Talents in which case you will remember that though the investment was found to be intact the management was superseded because it failed to produce dividends. The business is a half-failure which makes only half the profits it should make if it were properly navigated.

Eliminating Guess-Work from Navigation and from Business

One of the many wise observations made by that pioneer American, Benjamin Franklin, was that "invention and progress are prolific and beget more of their kind". To get the full benefit from one invention it is generally necessary to develop other inventions. The automobile would be of little value as a pleasure car if the pneumatic tire had not been invented—the aeroplane was dependent for its success upon the perfecting of the internal combustion engine, and Langley's much ridiculed model of a flying machine, which during its inventor's life time was a total failure, actually flew successfully when its original motor was replaced by a modern aeroplane engine. The full advantage of the speed of the steam locomotive could not have been realized had it not been for the development of those two safety instruments, the air-brake and the railroad semaphore.

It was the increase in the number, the weight, and the speed of ships which practically compelled the development of the art of navigation; guess-work methods which might have been tolerated when small sailing ships were the rule would obviously be impossible when applied to the operation of the Aquitania. One of the greatest steps ever taken in the advancement of navigation was the establishment in the year 1795 of the British Admiralty Hydrographic Office, the purpose of which was "to take the guess-work out of navigation," and this date practically coincides with the introduction of steam in navigation.

In a similar manner it was the increase in size, the complexity, and the speed of business which practically compelled the development of scientific management—as I wrote several years ago:

> It was inevitable that the idea of scientific management would be developed, for even if Frederick Taylor had not undertaken his investigations, the demands of the industrial world for some more scientific means of meeting manufacturing problems than were previously employed would have rendered the introduction of the scientific management idea a foregone conclusion.

In his recent book, "Everybody's Business," Floyd W. Parsons makes the following significant statement:

> In the past the progress of the United States has been due chiefly to the abundance of her raw materials; in the future America's advance must depend largely upon the mentality of her people. *The curse of the day is the habit of guessing instead of knowing.*

"Guessing instead of knowing" is extraordinarily prevalent in business—personally I am oftentimes appalled and astounded at the insufficiency of the information upon the basis of which captains of industry attempt to navigate the business vessels which trusting stockholders have submitted to their care. The old-time manufacturer, thanks to a large margin of profit, the law of averages, the defects of his competitors, and the grace of God, could more or less blindly follow in the footsteps of his fathers without necessarily being visited with instant disaster, but under modern conditions things change over night and, with high-speed business, disaster may come quickly and overwhelmingly as witness the case of the Goodyear Tire and Rubber Company, the balance sheet of which on October 31, 1919, showed a *surplus* of $33,332,666 and on October 31, 1920, a *deficit* of $15,647,654. It was poor navigation which caused this disastrous state of affairs, and remarkably good navigation which has since so greatly improved the position of this great business institution.

Modern business obviously needs four-wheel brakes, and those who know when they should be applied.

The Need for Science in Industry

We need have, we must have, more science in our business management. It is only by the aid of science that we can eliminate the guess-work in business in the same way as the Hydrographic Office through science eliminated the guess-work from navigation. Over 60 years ago Herbert Spencer foresaw the importance of science in business when he wrote:

> And if already the loss from want of science is so frequent and so great, still greater and more frequent will it be to those who hereafter lack science. Just as fast as productive processes become more scientific, which competition will inevitably make them do; and just as fast as joint stock undertakings spread, which they certainly will; so fast will scientific knowledge grow necessary to everyone.

To be scientific by no means requires that one should be engaged in laboratory work—as Professor J. Arthur Thompson states in his "Introduction to Science":

> Science is not wrapped up with any particular body of facts; it is characterized as an intellectual attitude. It is not tied down to any peculiar methods of inquiry; it is simply sincere critical thought, which admits conclusions only when they are based on evidence. We may get a good lesson in scientific method from a business man meeting some new practical problem, from a lawyer sifting evidence, or from a statesman framing a constructive bill.

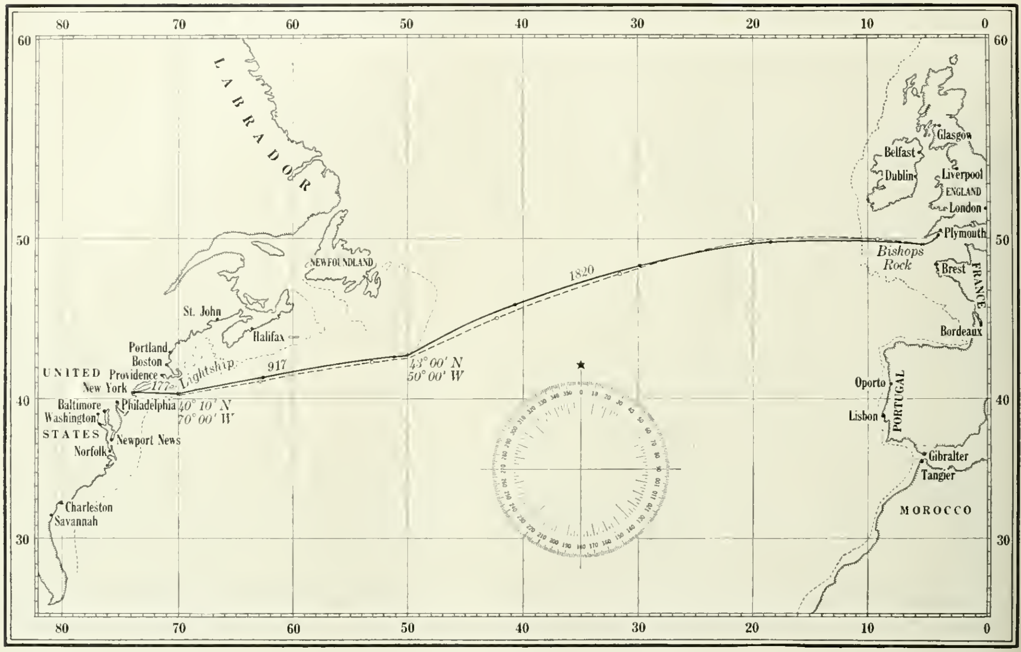
Scientific Management Means Science in Business

It is not the method which is important, it is the point of view, and if we regard business problems from the scientific standpoint we are practicing scientific management, for as the author said in his book, "Cost Accounting to Aid Production":

> Scientific Management is more than a system of shop management; it is akin to a state of mind, a mental attitude. Considered in its essential features scientific management represents the use of the trained imagination in industrial life—a looking forward rather than a looking backward—the doing of things mentally before the attempt is made to perform them on the physical plane. The office manager who desires to rearrange his office and who cuts pieces of paper to the scale of the furniture and shifts them around until he has found an arrangement which suits him, is practicing scientific management, whereas he who has all the furniture moved around bodily, only to find out that the original arrangement was best, is not. The traditional plumber arriving on his job without his tools represents the antithesis of the scientific management idea.
>
> Shorn of non-essentials, the underlying idea of scientific management is the predetermination of results and the standardization of methods and conditions. Instead of working to more or less nebulous ends, under scientific management methods, definite ideals are established and all efforts concentrated towards the attainment of these ideals by the adoption of standardized methods. This principle is applicable not only to the shops but to all phases of human activity.

The scientific management idea is as important, if not more important, in the sales, financial, accounting, and administrative divisions of the business as it is in the factory. With the development of automatic machinery and the adoption of scientific management in the factory the major industrial problem of America is no longer one of increasing production but a problem of improving our methods of distribution. One of the basic troubles today with many industries, the agricultural implement industry, for instance, is that we have increased our producing facilities entirely out of proportion to the capacity of the market to absorb. The result is that costs are increased and profits reduced by that industrial cancer "idle-time" to the detriment of the manufacturer, the worker, the consumer, and the community in general.

Even Frederick Taylor does not appear to have fully realized the far-reaching possibilities of the principles he enunciated—essentially a shop man, his horizon was naturally to a large extent confined to factory problems. Later exponents of scientific management have in the main followed in his footsteps—


80
70
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LABRADOR
NEWFOUNDLAND
St. John
Halifax
Portland
Boston
Providence
UNITED STATES
New York
177
Lightship
917
Baltimore
Washington
Philadelphia
40° 10' N
70° 00' W
Newport News
Norfolk
Charleston
Savannah
43° 00' N
50° 00' W
1820
Glasgow
Belfast
Dublin
Liverpool
ENGLAND
London
Plymouth
Bishops Rock
Brest
FRANCE
Bordeaux
Oporto
PORTUGAL
Lisbon
Gibralter
Tangier
MOROCCO

FIG. 1 NORTH ATLANTIC NAVIGATION CHART

Clarence Bertrand Thompson,[1] in the voluminous collection of articles on this subject issued by the Harvard University Press and edited by him, restricts the scope of scientific management entirely to the field of factory administration.

In view of the restricted viewpoint of scientific management held by most writers on this subject, it was a distinct surprise and pleasure to the author some days since to come across a little book by William Kent which, though written 10 years ago, indicates a much wider conception of the scope of scientific management than is held by most present-day exponents of this science. Mr. Kent defined scientific management as follows:

> Scientific management in its broadest aspect is not merely "labor-saving management," it is not even "shop management;" it is industrial management by the scientific method. It is not limited to cost of production, but extends to methods of distributing and marketing the product, to meeting the changes in character or fashion of the product, to questions of concentration or expansion, or relocation, of finance, etc.

Scientific management means applying science to the management of business. Probably one of the most important discoveries which science has made is the interrelatedness of all things in the universe; as one writer states it:

> Science regards Nature as a vibrating system most surely and subtly interconnected. It discloses a world of interrelations, a long procession of causes, a web of life, infinite sequences bound by the iron chains of causalty.

Scientific business management demands a proper understanding of the interrelatedness of things in business, an appreciation of the fact that the fortunes of the individual business are intimately bound up with those of its customers, its creditors, its competitors, and with business, financial, and political conditions in general. A drought in Kansas, a bumper cotton crop in Arkansas, a bank failure in California, an oil boom in Texas, a political scandal in Washington—anything which affects the ability and disposition of men to produce, to invest, to buy, and to sell, acts and reacts throughout the whole vast complex industrial organization. These are the currents and the cross currents in the industrial seas, which demand everlasting vigilance on the part of the business navigator.

Within the business itself what affects one department affects to some extent all other departments—there are in fact no strictly intradepartmental problems. An unexpected increase in sales, for instance, will result in a wave of activity passing throughout the whole organization, and will necessitate the making of adjustments in the plans and schedules of all departments. In the financial department it may require a rearrangement of the borrowing schedules. In the factory it may demand the speeding up of production, the employment of additional help, the changing of the working hours. In the purchasing department it may demand the making of additional purchase orders and hurried trips of the purchasing agent to the steel

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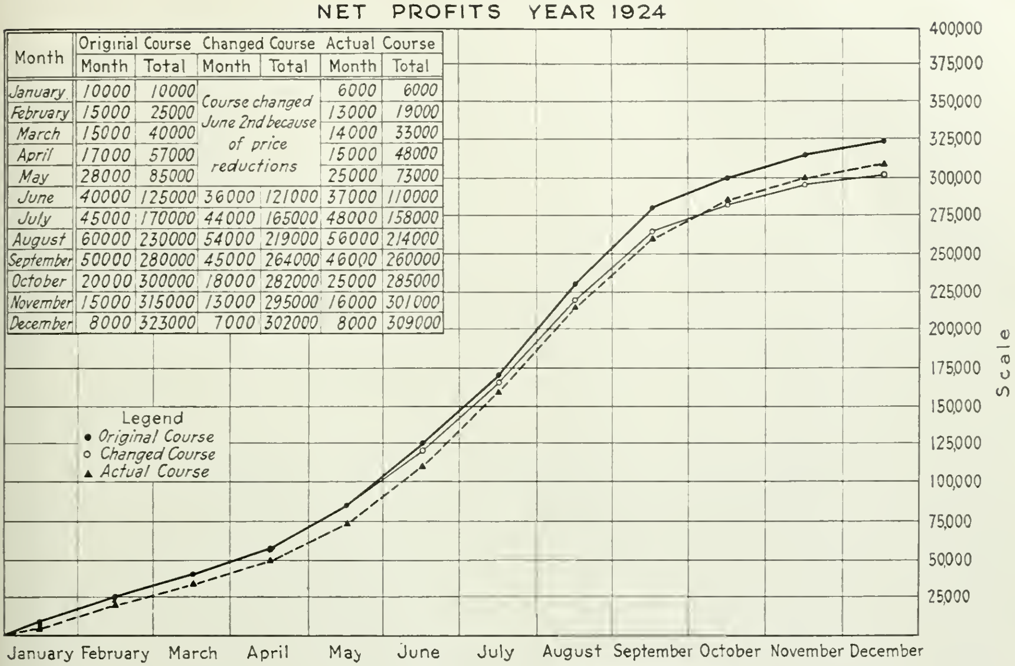
[1] Lecturer on Manufacturing in Harvard University.


NET PROFITS YEAR 1924

Month	Original Course		Changed Course		Actual Course	
	Month	Total	Month	Total	Month	Total
January	10000	10000	Course changed June 2nd because of price reductions		6000	6000
February	15000	25000			13000	19000
March	15000	40000			14000	33000
April	17000	57000			15000	48000
May	28000	85000			25000	73000
June	40000	125000	36000	121000	37000	110000
July	45000	170000	44000	165000	48000	158000
August	60000	230000	54000	219000	56000	214000
September	50000	280000	45000	264000	46000	260000
October	20000	300000	18000	282000	25000	285000
November	15000	315000	13000	295000	16000	301000
December	8000	323000	7000	302000	8000	309000

FIG. 2 BUSINESS NAVIGATION CHART

mills and other sources of supply—and the pay-roll and billing departments will probably be compelled to work overtime.

To make these necessary adjustments accurately, promptly, inexpensively and with the minimum of wear and tear on the organization, requires the application of the principles of scientific management to all of the departments of the business—it demands a breaking down of the unnecessary barriers which too often exist between departments, and the co-ordination of the methods, and policies, of all departments, so that all efforts can be concentrated to the realization of the one common end, namely, the earning of maximum profits.

Proper business navigation requires that all activities should be subject to centralized control—and this control can be exercised without in any way discouraging the exercise of initiative on the part of department heads. The engineer on the modern liner may have full steam pressure in his boilers, but he runs his engines at only quarter speed when he receives the signal to do so from the bridge. Perfect co-ordination between the driving forces in the engine-room and the directing forces on the bridge means maximum speed consistent with safety; and perfect co-ordination between the driving forces of a business and its directing heads means maximum profits with safety.

The practical man who is inclined to look with suspicion on the words "science" and "scientific management" should be reminded that science is the most practical thing in the world, for as that most eminent scientist Professor Huxley once stated "Science is nothing but trained and organized common-sense".

Can anything be more straightforward and commonsensible than the scientific management idea? If you believe that it is better to have a definite aim in business rather than merely to drift along you are a convert to scientific management. If you consider that in embarking upon a business venture you are wise to look before you leap you are advocating scientific management. As a matter of fact, though you may not realize it, you are practicing scientific management innumerable times every day of your life.

Scientific Management Extends Beyond the Shop

Scientific management is an art based upon a few simple fundamental and axiomatic principles—but to apply these principles successfully it is necessary to acquire a knowledge of the proper technique. There is a voluminous literature dealing with the technique of scientific management as applied to purely factory problems, but there is a great dearth of information regarding the application of these principles outside of the factory. This series of articles is being written with a desire to fill this gap to some extent, and in particular to furnish the business executive with simple detailed plans for a centralized business control system which will enable him successfully to apply the tried and tested principles of business navigation to the conduct of his own business to the end that he may derive greater profits therefrom.

Business navigation represents the application of three principles as follows:

1. Charting a course.
2. Periodical determination of actual position in relation to course laid down and analyzing variations according to causes.
3. Modifying course to conform to conditions which have come about.

Compare for a moment the Business Navigation Chart shown in Fig. 2 with the North Atlantic Navigation Chart shown in Fig. 1. In their essential features they are identical. The objective in the Atlantic chart is the arrival at Plymouth in a given time—the objective on the Business Navigation chart is the earning of a certain amount of profits in a given time. The Atlantic chart shows the position where the ship should be each noon and the position actually achieved; the Business Navigation chart shows the accumulated amount of profits which should be earned up to the close of each month and then the profits actually earned. It will be noted that, due to a change in conditions, namely, a cut in the selling price of the product assumed in the illustration, it was found necessary to draw a new course from the end of May to the close of the year.

In order to be able properly to forecast profits it is necessary that a survey be made of the business from several angles—it will be necessary, for instance, for the factory manager working in conjunction with the accounting and other divisions of the business to determine what the real capacity of the plant is in terms of product. Considering this information in relation to the market for the product, the next step will be for the sales department, also working in conjunction with the accounting department and with the management to figure what proportion of the factory capacity it is reasonable to expect can be disposed of by the sales force. In arriving at the decision in this matter careful calculations will have to be made as to where is the point of diminishing returns in sales effort; that is to say at what point does it become unprofitable to add additional salesmen and other sales expenditures in order to increase the sales. It will also be necessary to set sales quotas for the different sales branches.

Estimating Business Costs

Having arrived at a decision as to the amount of goods which it is anticipated can be sold, the next step is to predetermine the cost of manufacturing these goods, and the cost of selling and distributing them; in other words it will be necessary to set standards not only for factory costs but also for sales and administrative expenses. These matters will be dealt with in considerable detail in succeeding articles. It will also be necessary to figure the sales value of the goods which it is planned to sell, the difference between these estimated sales values, and the factory and selling and administrative costs representing the forecasted profits as charted on the Business Navigation Chart (Fig. 2). The information thus obtained forms the basis not only for charting the profits ahead as shown on Fig. 2, but also for the predetermination of the financial position for several months ahead. Factory and purchasing schedules for three months or more ahead (depending upon the conditions existing in the particular industry) will also be figured on this basis.

It is, of course, of supreme importance to know at frequent intervals to what extent the business ship has fallen off its course, or in other words to determine the extent to which the actual profits have varied from the profits which the management has set up as an objective. This information, however, is of limited value as an aid to getting back to the course, if the business navigator does not also have information as to what the causes are which have reduced his profits to less than the desired objective. It is of great importance, therefore, that means should be provided to furnish an analysis of variations from the estimated profits so that the management of the business can take immediate steps to eliminate, if possible, the profit-losing conditions.

If reference is made to Fig. 1 it will be noted that the estimated actual profits for the month of January were assumed to have been $10,000 when the profits were only $6,000. The first question the executive would naturally ask would be—"where have my $4,000 potential profits gone to, which have failed to materialize?" Under the methods to be described in the succeeding articles of this series his accountant would report somewhat as follows:

Estimated profits for month	$10,000
Actual profits for month	6,000
Profit loss	$4,000

TABLE 1. ANALYSIS OF ABOVE PROFIT LOSS BY CAUSES

	PROFIT	LOSS
Loss of profit on difference between estimated and actual sales (per detailed Statement A)	....	$5500
Increase in profit due to increase in selling price of product (per detailed Statement B)	$1000	....
Loss of profit due to selling larger proportion of less profitable merchandise (per detailed Statement C)	....	500
Increase in profit due to actual selling and administrative expenses being less than estimate (per detailed Statement D)	1000	....
Increase in profit due to reduction in manufacturing costs (per detailed Statement E)	3000	....
Idle time expense	....	3000
Net profit loss as above	4000	....
Totals	$9000	$9000

The above statement, of course, is intended merely to give the executive the all-important bird's-eye view of the situation—it answers by six figures the old, old question "where have my profits gone?" Supporting this summarized statement are detailed statements which provide an analysis in the finest detail of the figures shown on the summarized statement, for instance, Statement A would provide an analysis by branches and individual salesmen of the loss of profits due to the sales volume being less than the quota, thus localizing responsibility for a poor showing.

The next instalment of this series will give detailed information on methods of figuring profit objectives.

Cutting Shipping Costs

With the Lightweight Container

By HAROLD W. HAWK

Sales Promotion Manager, General Box Company

Index Number
658.78844 Wirebound boxes

IF all the money that has been lost during the past five years through damage to goods shipped by American business men could be collected in one purse, the total sum would pay a surprisingly large instalment on the requirements of the bonus recently passed by Congress. For years, damages caused by poor packing have reached staggering amounts. In spite of the fact that the shipping problem is as old as business itself it has been only within comparatively recent years that any decided progress has been made in packing efficiency. Back of this progress have been many forces, and back of these forces have been a variety of contributing factors.

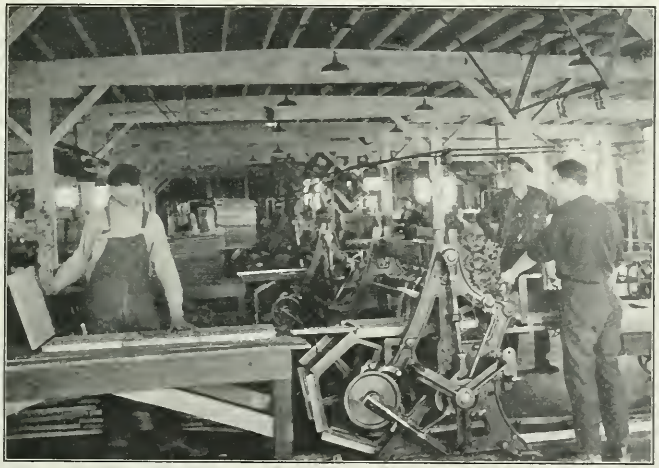


Fig. 1 Giant Multiple Sewing Machine Used in Manufacture of Wirebound Boxes

Today American packing is on the highest plane in its history. No less an authority than Julius Klein, Director of the United States Bureau of Foreign and Domestic Commerce, is responsible for the statement that: "While in the past American packing methods have been roundly criticized, and perhaps rightly so, there has been such a notable improvement in recent years that our competitors in the world's markets now openly admit that the United States is far in advance in this important matter. Except in rare instances improvement in packing methods has kept pace with modern methods of production and distribution, and packing is today regarded as an exact science by experienced exporters."

American business men long ago recognized the value of applying science to industry. In fact, science has been largely responsible for placing American industrial enterprise in its present position of world leadership. There is scarcely an American industry that has not profited through research activities, carried out individually or through co-operation in the form of trade association laboratories. Production problems have been solved by keeping everlastingly at them with scientific treatment. And the same holds true with packing problems, which are closely related to production problems, for without proper packing and efficient distribution, production efficiency would largely be wasted.

During the past 15 years the history of packing development has been largely one of decreasing the size and weight of containers and at the same time maintaining or increasing their strength and serviceability. There was a time, and not so many years ago, when the workman of the shipping-room was chosen with respect to his huskiness and his ability to handle a hammer and a saw. Lumber was plentiful and cheap, and a handy man could nail a few boards into some sort of a shipping case with little trouble. Whether the case arrived at its destination in good shape was generally left to the railroad.

As production in industry increased and shipments grew to large volumes, the slipshod packing methods began to give more and more trouble. Damages from broken packages became heavier and heavier. Poorly constructed containers invited pilferage. It was an ideal situation for scientific development to take hold of and master, for good packing includes the solution of any number of problems, most of them beyond the grasp of an ordinary laborer. They need the attention of engineering skill, and because such skill has been generously provided much of the worry has been taken out of the packing problem.

It is safe to say that the average weight of shipping containers today is fully 50 per cent less than it was 15 or 20 years ago. Due to proper study of construction, efficient nailing, and adequate reinforcing, where necessary, or by the use of wirebound boxes, the loss and damage claims today are lower than ever before in the history of the railroads. The records of the Southern Railway give some interesting information along this line. In 1921 the claims paid by this road amounted to $3,015,258.40 or 2.75 per cent of the tariff. In 1922 the claims were reduced to $1.559,724.68 or 1.28 per cent of the tariff, and in 1923 they were further reduced to $1,495,039.40 or 1 per cent of the tariff. Of course it would be unfair to attribute *all* of these savings to better boxing and crating methods alone, but they have unquestionably played an important and an ever-increasing part.

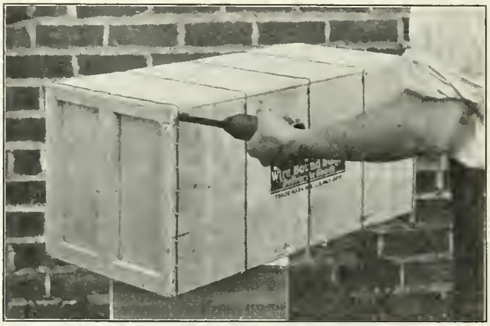


FIG. 2 WIREBOUND BOXES ARE QUICKLY CLOSED BY TWISTING THE WIRES WITH A SPECIAL TOOL

Back of this development of lighter containers have been many factors. One of the chief ones was the rapid depletion of our forests. In 1907 lumber of the grade used in boxes was selling at $15 per thousand bd. ft. Today that lumber is selling at $38 per thousand bd. ft. Study of methods to help save lumber brought out the fact that strong boxes could be made with less material. Boxing experts of the United States Forest Products Laboratory at Madison, Wisconsin, discovered that:

> . . . in some cases it is possible to reduce the thickness of material 20 per cent or more and at the same time permit the use of a poorer grade of lumber, when metal bindings are properly used, without any reduction in the serviceability of the container.

In the wirebound box, the thickness of the sides, tops, and bottom, and frequently the ends also, may be reduced as much as 50 per cent under that of an unstrapped box designed to carry the same goods, and still give a stronger box. Something over 5,000,000,000 ft., bd. measure, of lumber are used annually in making containers, and hence a saving up in the tens of millions of dollars is possible by the application of scientific principles to packing methods.

Although iron strapping and wire have been used for years in binding shipping boxes, the new idea produced by the wirebound box makes the wire primarily a part of the supporting structure. In the construction of this type of container, rotary cut lumber or thick veneer can be used for all parts excepting the frame. Red gum is used in most cases, although large quantities of long-leaf pine, tupelo, black gum, cottonwood and poplar are also in demand at the mills.

Arriving at the plant the logs are submerged in ponds to protect them from insects. They are then snaked out and cut into standard butt lengths, varying from 30 to 60 in. Twelve or fourteen of these butts are then dumped into a huge vat where they are boiled or steamed for a number of hours—varying from 16 to 32—or until they are softened to the core. They are then hooked out and swung on cranes to high speed, automatic lathes, capable of turning out large quantities of rotary-cut lumber each hour.

Logs Cut Into Thin Strips

When the soft log butt is placed on the lathe, the razor-sharp edge of the knife is so adjusted that it meets the edge of the revolving log, thus cutting a thin strip the full length of the butt. The operation is similar to the unrolling of a roll of wall paper. The usual thicknesses are ⅛, 3/16, ¼, and 5/16 of an inch. As the log revolves the strip comes off on the lathe table and practically the entire log can be "pared" into a single strip, leaving only a small core. The long strips are cut, by machinery, into desired widths as they come from the lathe. These strips are then sent to drying kilns. The next step brings into operation a machine which is nothing more or less than a huge sewing machine. (See Fig. 1). It takes the strips of wood in one end and turns the finished box out of the other, and so simple is the operation that expert labor is not required. Many of the machines,

FIG. 3 TYPE OF BOX USED BY AMERICAN CHAIN COMPANY

operated by women, have turned out as much as three and one-half miles of boxboard in a single day. A short time ago one of the box plants manufactured 800 miles of boxboard in one month.

Box-Board Sewing Machine

The sewing machine operates on the same principle as the machines used in the clothing industry. At one end is a small track and the cleats or supports of the box are laid on this track with the strips of rotary cut lumber on top of the cleats. This "layout" goes into the machine and comes out as a finished box. The machine performs a number of operations. If the box is bound with three wires, the machine cuts and makes the staples for each line of wire, runs the wire in the proper place, and drives the staples over the wire at regular intervals. This operation can be duplicated with as many as 9 strips of wire. The staples are not only driven into the wood, but the ends are bent over to give added holding power.

The boxes are shipped knocked down, in a flat condition. The cost of assembling is approximately two-thirds lower than with an ordinary box. In the shipping-room a workman merely folds the section, which will become one side, at right angles to the others, tapping each corner with a mallet so that the tongue of one set of cleats will fit snugly into the grooves of the next set. And so on with the other sections, except that the last, or lid, is left open. When the contents are inserted the lid is closed and the wires fastened. (See Fig. 2). The goods are then ready for shipment.

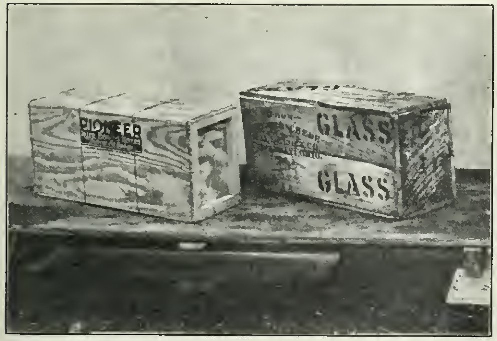


FIG. 4 THE WIREBOUND BOX SHOWN SAVES 8 LB. IN WEIGHT EVERY SHIPMENT, AND FURNISHES BETTER PROTECTION THAN THE HEAVIER CONTAINER

Naturally the question arises—"in using this lighter material, is there sufficient strength to withstand rough traffic handling?" In a series of tests conducted some time ago it was found that a wirebound box fully packed with cans withstood 58 drops of 18 in. before bursting, as compared with 31 drops of the same distance for an ordinary packing case of the same dimensions and contents. In a "tumbler" test a huge barrow operating like a concrete mixer was used. The wirebound box began to show sufficient abrasion at the end of 300 tumbles to be considered no longer safe. An ordinary box burst its sides and end and spilled its contents after the one-hundred and thirtieth tumble. The American Chain Company carried out a test with similar results. In this case, two boxes of the same size, one a wirebound box and the other a 13/16 in. wooden box, were packed with about 250 lb. of chain and dropped 25 ft. onto a concrete pavement. While the wooden box was entirely shattered and the contents thrown out, the wirebound box, although knocked partially out of shape, was not opened and did not lose its contents.

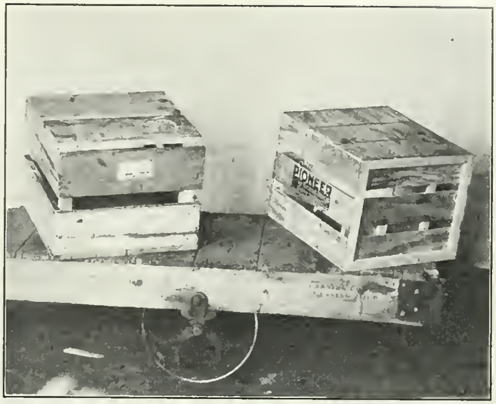


FIG. 5 THIS WIREBOUND BOX SAVED 9 LB. IN WEIGHT OVER THE BOX THAT WAS REPLACED

Perhaps the best way of outlining the advantages of these lightweight containers is by giving a definite example of the results obtained by individual shippers. The American Chain Company adopted wirebound boxes about 12 years ago, after carrying out tests that showed their superiority over the 13/16 in. shooks that had formerly been used. This company uses wirebound boxes for express, freight, or coastwise shipments to all parts of the United States, and also for most foreign shipments. The contents include automobile accessories, and chains for automobiles, sash, plumbers, ships, etc. About 34 different sizes and shapes of boxes are used with a monthly requirement of about 10,000. (See Fig. 3). Records of the company show that the average reduction in weight compared with the 13/16 in. wooden shooks formerly used, amounts to over 35 lb. per box. This difference is most important because the products are shipped to all parts of the country. Since the average rate exceeds 95 cents per 100 lb. the saving in shipping cost amounts to $3,325 a month. (See Figs. 4 and 5).

In addition to this saving, a lower first cost is obtained. Wooden shooks cost on the average at least 10 per cent more, and about 3 per cent of them were lost by splitting. Thus there has been an average saving of $455 a month in these items. The company also reports a saving in labor from the speed with which the wirebound boxes can be handled, set up, packed, and closed. For each shipment made this savings amounts to an average of at least seven employee minutes. At an average wage of 50 cents an hr. this saving amounts to $583.33 a month. The total saving from the use of the wirebound boxes has been $4,363.33 a month or $52,359.96 a year. This is equivalent to reducing the average boxing and shipping cost 44 cents a shipment, or more than the entire average cost of the boxes themselves.

Additional savings and advantages, difficult to reduce to a dollars and cents basis, have been enjoyed by this company. Wooden shooks required separate piles in the warehouse for the ends, tops, bottoms, and sides for each size and style of box. As the wirebound boxes come knocked down, a saving in storage space has resulted, or a larger stock can be kept on hand if desired. This is an important advantage because it reduces the possibility of shortage. (See Fig. 6). A unique advantage of the lightweight, wirebound containers was recently pointed out by an official of the chain company. It was that the wirebound boxes proved very useful for reshipping after they reached the distributors or customers. "The distributors often open up the boxes, remove some of the contents, replace them with other articles, and close up the boxes for reshipment," said this official. "While this is readily done with wirebound boxes, it would be difficult to do with strapped wooden shooks. Our sash chain is delivered to the contractor on reels packed in special boxes in such a way that any amount can be taken from the reel and the boxes closed for reshipping." (See Fig. 7).

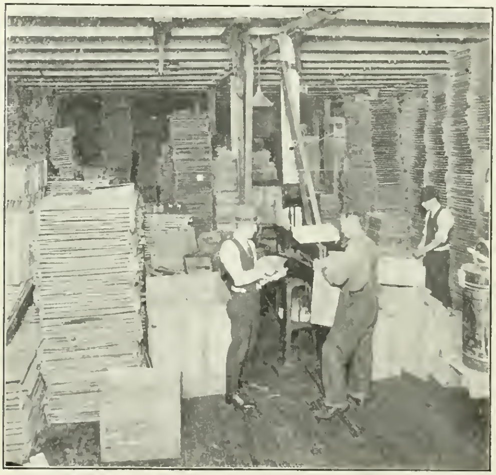


FIG. 6 WIREBOUND BOXES; THREE-FOURTHS ASSEMBLED, SAVE 90 PER CENT OF STORAGE SPACE OVER MADE-UP BOXES

They are assembled by folding to shape and nailing in the ends either by hand or with the stapling machine illustrated.

Over a year ago the White Provision Company began using wirebound boxes and crates. They now use about 2000 of these containers a week. One result has been a reduction of 3.5 lb. in the weight of their average shipment or a saving of $728 a year. By cutting the assembly labor from $0.025 to $0.005 a box, the wirebound containers have saved $2,080 a year. (One boy, at 25 cents an hr., easily assembles 200 boxes an hour). The cost of assembly on the wooden shooks averaged between $0.01 and $0.04 cents, depending on the size. An additional annual saving of $6,240 in initial cost increases the total to $9,048 a year. The principal sizes of containers used by the company range between a 6-lb. capacity with dimensions of 11 x 12 x $2\frac{1}{4}$ in., to 300-lb. capacity with dimensions of 30 x 25 x 14 in. In these containers are shipped sausage, smoked meat, fresh pork, dry salt pork, etc. Shipments are made mostly to points in the state of Georgia or to local customers. The principal advantage of the wirebound boxes and crates over the sawed lumber containers formerly used lies in their reduced weight. Table 1 shows the extent of this reduction:

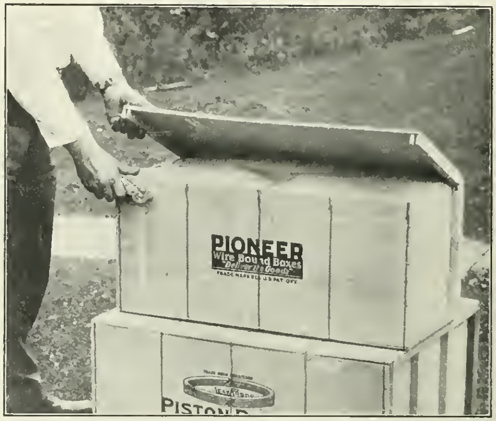


FIG. 7 A WIREBOUND BOX RECEIVED AT DESTINATION IS OPENED BY CLIPPING THE WIRES AND RAISING THE LID

TABLE 1. COMPARISON OF WEIGHT OF WIREBOUND BOXES AND SAWED LUMBER CONTAINERS

CAPACITY lb.	WEIGHT SAWED LUMBER BOX lb.	WEIGHT WIREBOUND BOX lb.
25	6	3.5
50	9	5.5
100	11	7.1

The field of these lightweight containers embraces shipments up to 500 pounds. Experience has proved that such weights can be successfully carried. In this field, wirebound boxes meet many of the daily shipping problems. The arrangement of the wires makes the container a difficult thing for the thief to tamper with. The method of closing automatically seals the box. (See Fig. 4). Weighing from 30 to 50 per cent less than the old style wooden box, with no loss of strength, the economies are self-apparent.

After all is said and done the proper approach to the boxing problem begins with the article to be shipped and not with the container. The point is to find out what strain is going to be put on the contents, and then build a box strong enough to meet that strain.

Industrial Budget Methods

By JOSEPH H. BARBER

Staff Assistant to the President, Walworth Manufacturing Company

Index Number
658.14 Financial control

THE industrial budget is here to stay. Its enthusiasts are no longer forced to defend it, for the tables have turned. Today, its merits are substantiated by hard-headed administrators, who evaluate the budget as a profitable investment. Tomorrow, the recreant on defense will be the industrial administrator *without* a budget.

Just as the establishment of a budget presumes an accountable — financially accountable — organization before there can be a virile budgetary control, so forecasting as a vital aid for guidance of that executive control presumes some specific provision for the "meeting of many minds," and the existence of natural channels for the interflow of influences. The natural leader still radiates stimulating power, but now he must fix sales quotas and performance standards, based upon external business conditions and internal operating capabilities. The subordinate still desires to qualify for advancement, but acknowledges the burden of the budget as a test of his capacity and as a goad to a broader conception of his job.

The business man who sees, even obscurely, the future course of business has a tremendous advantage over one who does not see it at all. Formerly, the astute business man depended upon his personal judgment, or perhaps a "hunch" to give him this information. Today he "figures it out" from his records and from the general trend of business—and frequently with surprising accuracy. In this series of articles, Mr. Barber explains the methods of scientific forecasting and shows the results that can be attained.

On the other hand, the adoption of a budgetary procedure, with its consequent periodic estimating, does not presume that there is "forecasting," in Webster's sense—"the anticipation of consequences and provision against them". On the contrary, the prime objections to the introduction of budgetary methods into industrial organizations have arisen out of the obstacles, in many industries, in the way of accurately "anticipating consequences," as a basis for certainly "providing against them".

The purpose of this series is to indicate that much can be accomplished even in the face of difficulties. The discussions are in the nature of testimony concerning the economic forecasting methods developed in a typical industrial concern for vitalizing executive control through its budget.

The development encountered, first, the haze of incomplete specific data concerning business in general; then, the tempest of apparently conflicting forecasts (presumably all intended for consumption and direct application to any business); and, latterly, a flood of relevant and irrelevant statistics surging from all points of the compass. The writer has listened to the insistence of one author that 60 per cent of the fluctuations in an industry are caused by external economic factors. His confidence in the result of such business cycle analysis has, however, been restrained by the fact that, to prove their point, most of the business cycle theorists have selected data of very wide fluctuations; and that that data, selected because it is "sensitive," should be labeled—"Pertains to certain distinct types of production or distribution only. Not a typical sample of industry!"

This fact deserves recognition. On the other hand, however, the author of this series is himself associated with an industry that is of the type having violent fluctuations, or cycles, not easily anticipated. The series is, therefore, written for those who face similar fluctuations as a matter of known fact, and who would achieve a solution to a very real problem, common to many industries.

The problem is difficult just because it is so much affected by the human element. It is human for every concern to strive for a "larger slice of the pie". This, combined with the difficulty of determining possibilities upon a matter-of-fact basis, produces the condition which exists today under which the ups and downs of business are progressively more violent as industrial units are more widely separated from the ultimate consumer, and as individual industries increase in magnitude.

These are facts demonstrated in many ways. Witness, the orders placed for pig iron, which is a "producer's" product as distinguished from a "consumer's" product. Four times since the war, inside of periods of four months or less, the monthly rate of pig iron orders has gone up at least 60 per cent, and then down again to levels in the next six months not exceeding one-third of the peak level. Witness, further, the findings of the National Bureau of Economic Research: that the United States average decline in employee earnings—a fair measure of productive activity—from 1920 peak to 1922 valley, registered 23.2 per cent. Though the depression caused the smallest size concerns to reduce their wage bills only 5 per cent in that period, every industrial concern large enough to employ 100 or over registered at least 33 per cent decrease in earnings.

David F. Jordan has said, "The gains which come from the ability to foresee the trend of general conditions—conjunctional profits—far exceed the margin

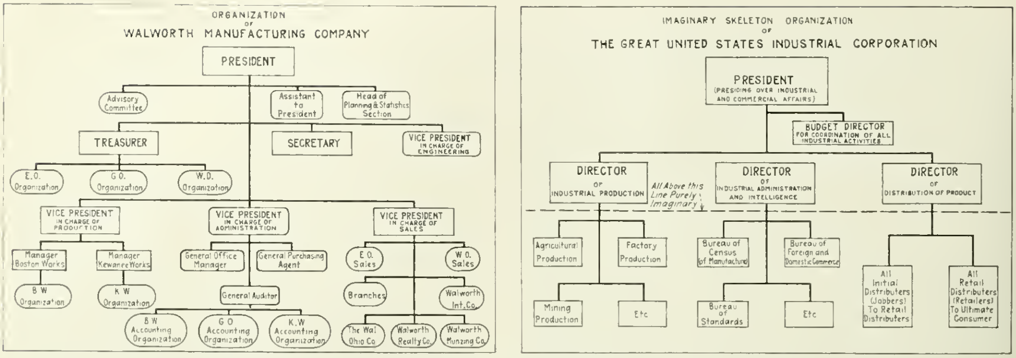

ORGANIZATION OF WALWORTH MANUFACTURING COMPANY
PRESIDENT
Advisory Committee
Assistant to President
Head of Planning & Statistics Section
TREASURER
SECRETARY
VICE PRESIDENT IN CHARGE OF ENGINEERING
E.O. Organization
G.O. Organization
W.O. Organization
VICE PRESIDENT IN CHARGE OF PRODUCTION
VICE PRESIDENT IN CHARGE OF ADMINISTRATION
VICE PRESIDENT IN CHARGE OF SALES
Manager Boston Works
Manager Kewanee Works
General Office Manager
General Purchasing Agent
E.O. Sales
W.O. Sales
B W Organization
K W Organization
General Auditor
Branches
Walworth Int. Co.
B W Accounting Organization
G O Accounting Organization
K.W Accounting Organization
The Wal Ohio Co
Walworth Realty Co.
Walworth Munzing Co.
IMAGINARY SKELETON ORGANIZATION OF THE GREAT UNITED STATES INDUSTRIAL CORPORATION
PRESIDENT (PRESIDING OVER INDUSTRIAL AND COMMERCIAL AFFAIRS)
BUDGET DIRECTOR FOR COORDINATION OF ALL INDUSTRIAL ACTIVITIES
DIRECTOR OF INDUSTRIAL PRODUCTION
All Above this Line Purely Imaginary
DIRECTOR OF INDUSTRIAL ADMINISTRATION AND INTELLIGENCE
DIRECTOR OF DISTRIBUTION OF PRODUCT
Agricultural Production
Factory Production
Bureau of Census (of Manufactures)
Bureau of Foreign and Domestic Commerce
All Initial Distributers (Jobbers) To Retail Distributers
All Retail Distributers (Retailers) To Ultimate Consumer
Mining Production
Etc
Bureau of Standards
Etc

FIG. 1 ORGANIZATION CHART FOR A TYPICAL CONCERN AND SUGGESTED ANALOGY FOR INDUSTRY AS A WHOLE

Boxes with square corners indicate line executives; boxes with rounded corners indicate staff heads; boxes with rounded ends indicate organizations.

of pure profits which competition holds within narrow limits."[1] In the past 50 years the great savings leading to unusual profits were derived from economies in the field of production. There is a growing feeling that, in the next 50 years, similar unusual profits will be achieved more largely through wise administration.

There is to be greater economy in utilization of the complete plant. To survive, there must materialize the savings built into a well-assorted inventory, produced at low costs *before* the rush of orders generates inefficient, feverish activity. But such calm planning requires assurance of an imminent trade boom.

There must be a precise direction of working capital. Prior to the boom it is well invested in inventories. During a boom it will be shifted into accounts receivable. With the passing of the boom, it will be converted to cash to assure a fluid condition and to liquidate current borrowings. Again, these economies are possible only if the future has been anticipated with fair accuracy.

Moreover, the surviving concerns know when to buy right. When *they* have "covered" for a fair period ahead, the producers, in self-protection, are forced to dam up the flood of orders from the laggards by raising prices. The laggards are not the surviving concerns, for they buy late and high. Then, being forced to await deliveries, they produce late and at increased wage costs, with a consequent later selling when prices are sagging.

It will be interesting to note just how far this sequence operates in the case of foundries, as indicated by these facts pertaining to pig iron ordering, or "covering".

> In the 1919-1920 price movement, 60 per cent of the pig iron orders placed during the two years were placed before prices had advanced half-way up to their 1920 peak. During the six months of sustained peak prices in 1920—25 per cent of the time—there was placed but 15 per cent of the total orders of those two years.
>
> In the 1922 movement, at the price low point in April, 77 per cent of that year's orders were placed before the price had increased one-third from the low point to the October high point.
>
> In the succeeding 15 per cent drop to the low in January 1923, in the period from December 1922, to March 1923, 75 per cent of 1923 requirements were covered before the price rose half-way to the 1923 high point in May.

How certainly high prices operate against the "marginal producer" is evident. In the platform upon which he solicits customers' business, he may attempt to strengthen the planks "Quality," "Service," "Personal Attention," or any others, but is it not an inconsistent fact that all these planks will buttress the four sides of the survivor's main claim, "Low Price"?

TABLE 1. COMPARISON OF A CLASSIFICATION OF SUB-DEPARTMENTS OF INDUSTRY WITH A CLASSIFICATION OF THE PRODUCTS OF A TYPICAL INDUSTRY

WALWORTH PRODUCT CLASSIFICATION		UNITED STATES PRODUCT CLASSIFICATION	
01	TOOLS	01	FOOD AND KINDRED PRODUCTS
011	Stillson wrenches and parts	011	Slaughtering
012	Die plates, taps, dies and reamers	012	Confectionery
013	The Walworth chain (Boston) wrenches	013	Flour
014	Other Walworth wrenches		Etc.......
015	Other tools—Walworth make		
02	KEWANEE SPECIALTIES	02	TEXTILES AND THEIR PRODUCTS
021	Nat'l flanged unions (only)	021	Cotton goods
022	Kewanee unions (only)	022	Hosiery and knit goods
023	Kewanee flanged unions (only)	023	Silk goods
024	All other Kewanee specialties	024	Woolen and worsted goods
		025	Carpets
			Etc.......
03	GREY IRON PRODUCTS	03	IRON AND STEEL AND THEIR PRODUCTS
031	Grey iron screwed fittings	031	Iron and steel
032	Grey iron flanged fittings	032	Foundry and machine-shop products
033	Miscellaneous grey iron	033	Hardware
			Etc.......
Etc.		*Etc*	

The problem of forecasting will be more clearly understood if we liken the organization of all industry to the organization of a typical industry. The analogy will prove useful in a later further inquiry to ascertain the degree of dependence of one department of industry upon the concurrent activity, or lack of activity, of all other departments.

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[1] Preface to "Business Forecasting".

Fig. 1 shows the organization chart for a typical concern and a suggested analogy for industry as a whole. The writer hopes that he will not be thought socialistic because he draws this analogy. It is not possible, nor desirable, that there should be established any "over-all" organization as imagined. However, the analogy will stress the fact that forecasting analysis is but an extension of the principles recognized in budgetary analysis, namely, adjustment and constant readjustment of all activities to assure balance. Of course, there is no president as the guiding executive of "All Industry," nor can there be any budget executive to attempt the co-ordination of the activities of "All Industry's" sub-departments. Nevertheless, it is well to bear in mind, as Table 1 indicates, just how closely a classification of these sub-departments of industry would resemble the classification of the products of a typical industry.

BLANK INDUSTRIAL CORPORATION
Anywhere, U. S. A.

To MR. JOBBER'S BUYER, *Anywhere, U. S. A.* Oct. 1, 1924 (Invoices Rendered Monthly)

QUANTITY ORDERED	UNIT	DESCRIPTION OF PRODUCT	PRICE	VALUE
000	Feet	2 in. Galv. iron pipe	$0.00	$00.00
00	Only	2 in. Galv. beaded elbows	0.00	00.00
00	Lb.	Palmetto packing	0.00	00.00
0	Cans	Graphite for pipe joints	0.00	0.00
00	Doz.	Stillson wrenches	0.00	00.00
				$000.00

THE GREAT UNITED STATES INDUSTRIAL CORPORATION
Everywhere, U. S. A.

To ASSOCIATED CONSUMERS, *Everywhere, U. S. A.* Oct. 1, 1924 (Invoices Rendered Monthly)

QUANTITY ORDERED	UNIT	DESCRIPTION OF PRODUCT	PRICE	VALUE
000,000,000	Bu.	Corn	$ 0.00	$ 00,000,000
0,000,000	Tons	Pig iron	00.00	00,000,000
00,000,000	Bbls.	Wheat-flour	0.00	00,000,000
00,000,000	Prs.	Shoes	0.00	000,000,000
000,000,000	Gals.	Gasoline	0.00	000,000,000
				$00,000,000,000

FIG. 2 INVOICE STATEMENT OF A TYPICAL INDUSTRY AND ANALOGY

Rapid strides in the development of engineering technique and in the increasing utilization of the fruits of engineering analysis, were not possible until terms, units of measurement, and so forth, had been definitely standardized. The analysis of business conditions cannot make its rapid strides until there is some similar segregation of ideas and meanings associated with certain terms, nor until, for certain purposes of analysis, only certain standardized units of measurement are utilized. For some time in business analysis the use of index numbers has provided a common denominator for comparison of movements originally recorded in various units of measurement. On the other hand, there is still general confusion in interpreting the meaning of various movements due to indiscriminate comparison of poorly labeled and illogically grouped business data.

To illustrate very necessary distinctions in kinds of business data, Fig. 2 first presents a customer's invoice statement from a typical industry. It is a bill of assorted goods, sold during the previous month, and the invoice itemizes quantity, price, and value. The other monthly invoice is of the sum total of "All Industry"—a "Monthly Control Charge Sheet," if you please, of all the subordinate industries.

Picture for a single industry, a stack of all its month's invoices. Then, if the quantity units (reduced to some common denominator of, let us say, pounds) were added, the total would represent in quantity form the activity of that particular industry for the month then under consideration. Against the resulting total quantity for this month, and under the table heading "Description of Product," the Monthly Control Charge Sheet would carry but one item descriptive of that industry as a unit. In the price column would appear the average price of all that industry's product sold during the month, and the extended value amount would represent for that month that industry's charge against the purchasing power of the consuming public. Then if we carry this same procedure through all industry, listing each unit in order, we have our typical industry on the one side conducted in a fairly comparable way with the activity of all industry on the other side. It is this comparison which is shown in Fig. 2.

TABLE 2. INTER-INDUSTRY RELATIONS

ORDER OF SEQUENCE IN WHICH AFFECTED BY CYCLE MOVEMENTS	LABEL (A)	ACTIVITY (B)	TYPE OF PERSONNEL (C)	NATURE OF ACTIVITY (D)	ELEMENTS OF INDUSTRIAL ORGANIZATION[1] (E)	SEQUENCE OF ACTIVITIES (F)	CLASSES OF MATERIAL[2] (G)	ACTIVITY MEASURED BY[3] (H)
1	Anticipators	The Cause	Speculative	Underwriting	Manufacturer	Orders and Commitments	Raw Material	Quantity
2	Imitators	The Act	Average	Merchandizing	Jobber	Production, Shipments and Goods Exchange	Producers' Goods	Price
3	Laggers	The Consequence	Conservative	Demand for and Exchange of Money	Retailer	Collections and Readjustments	Consumers' Goods	Value

[1] See Fig. 1. [2] See Table 1. [3] See Fig. 2.

We may now attempt to show how closely interrelated are all the activities and all the departments of this supposed "Great Corporation". The initial suggestion of the interrelations may be best advanced as shown in Table 2. In forecasting, we attempt to analyze the sequence of fluctuations in the volume of trade, which infers the lapse of time. Therefore, the table catalogs the elements of our analogies with respect to the time sequences in which they are affected during any broad fluctuation in business—that is, during a "business cycle". The elements are roughly segregated into three classes: the "anticipators," the imitators," and the "laggers."

In Table 2, it may seem out of place to classify the manufacturer as a cause of retailer prosperity during, let us say, a recovery period following depression. In one sense, he is not, but on the other hand analysis through many cycles develops just the time sequence indicated. Moreover, it should be so. Kind seeks kind. After a depression, and in the anticipation of better business ahead, the speculator will underwrite the manufacturer's commitments of raw materials in larger quantities. Then the average business man or merchant takes his cue, trades and exchanges more of the manufacturer's or producer's goods to an extent justifying general price increases. The conservative individual, who can be induced to risk only a "sure thing," pays cash in settlement for consumers' goods which he buys in fairly large volume, even after both increasing quantities and price have developed inflation.

Noting more particularly the final column in the table, and again recalling the conception of a Monthly Control Charge Sheet for the "Great Corporation," we may see how essential it is to understand the relation between quantity, price, and value movements. It is the purpose of the later articles of this series to analyze the several interrelated movements of the various elements of the Great Corporation's activities during a business cycle. Nevertheless, it will be emphasized here that we shall always fall short of intelligent analysis of true trade conditions if we fail to recognize that any value "barometer" is really an average of two elementary barometers, each a measure of two aspects of the same data. Truly, in so far as increasing quantity volumes concur with rising price levels, our impression of business intensity is erroneous only to the extent that the magnitude of the real movement is exaggerated. On the contrary, we are directly misled when both are at the peak. For there is a period, usually of some six months' duration, when the quantity will have declined while prices are still rising, with the net result that value "barometers" show neither the volume trend, nor the price trend.

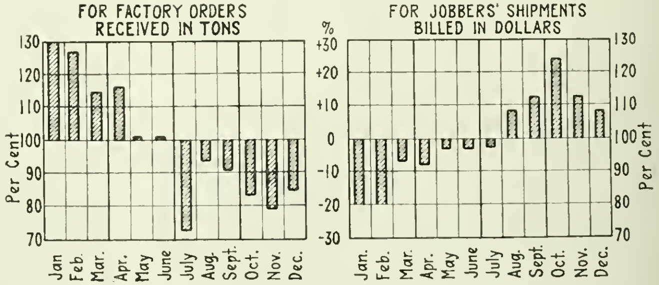


FIG. 4 CONTRASTING TYPICAL SEASONAL VARIATIONS DIVESTED OF OTHER COUNTERACTING INFLUENCES AND EXPRESSED IN PERCENTAGES

100% = The average month of the average year.

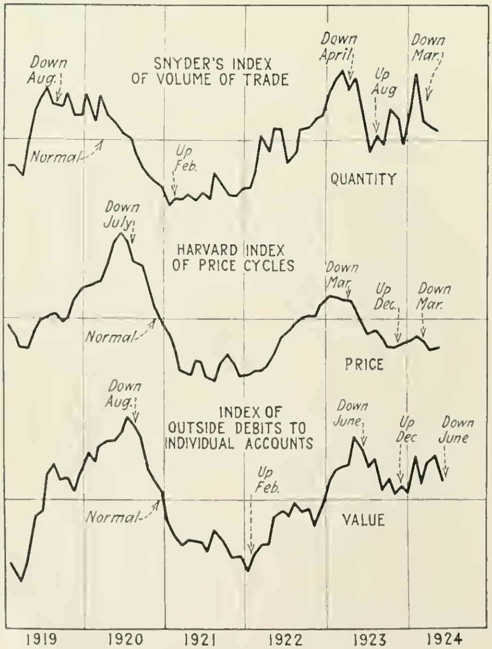


FIG. 3 RELATION BETWEEN QUANTITY, PRICE, AND VALUE CYCLES

The point cannot be pursued further, but Fig. 3 is presented to suggest how an interpretation of all three movements yields a much more specific impression than does the implication of the value barometer alone. We are indebted to Carl Snyder, chief statistician of the Federal Reserve Bank of New York, for developing a broadly representative index of the quantity fluctuation of trade in the post-war period, and to the Harvard University Committee on Economic Research for a sensitive barometer of price cycles, corrected for secular trend. The curves of these different barometers are drawn so that each will appear to have about the same size fluctuations. This is not so in fact, for prices and values, being much more "sensitive," have very marked fluctuations as compared with the moderate movements of Mr. Snyder's quantity index. Our purpose here, moreover, is to note the time sequences only, and that quantity barometers move first. In this connection, it is interesting to remember that Mr. Snyder pointed out in his December 1923 article[2] that his Index of Trade turned up or down with, or slightly ahead of, stock market prices. This point justified our classification of quantity business cycle variations *with* the "anticipators," the "causes," and with "speculation".

In our approach to the solution of our problem, we must pursue the analysis of elements one step further. Again resorting for analogy to the engineering profession, an engineer may design his building in advance because, column by column, beam by beam, he calculates and allows for all the loads and stresses—vertical, oblique, and lateral, direct and indirect—with a margin of safety for flaws or erratic spots in the humanly produced material. And he thus economically designs in advance a building that will stand all the loads and stresses anticipated.

---

[2] "A New Barometer of Industry," by Carl Snyder, MANAGEMENT AND ADMINISTRATION, December 1923.

Similarly, in the analysis of the fluctuations of any business series—even of a series in quantity units, as is desirable—there must be a "resolution of forces," to segregate for separate study each of the several causes which have jointly determined the degree of intensity of any month's activity. To be specific, let us assume that this month's shipments register 2000 tons and then ask—Will next month's volume change? In what direction will it change? If it is to change, how far will it go? As we stand in the present and are forced to anticipate a possible change in the future, we must always ask—When? In what direction? And to what extent?

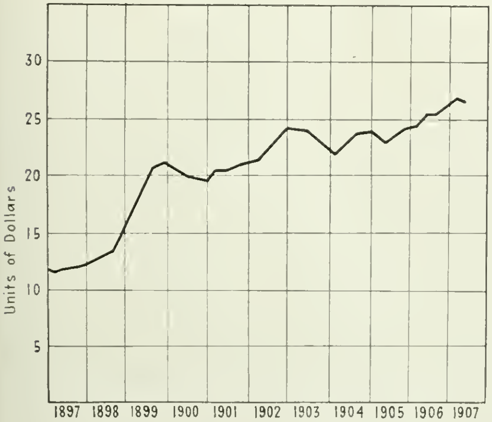


FIG. 5 TEST TO REVEAL CYCLE FLUCTUATIONS

In attempting an answer, we may inquire concerning the probable or potential influence of four basic types of fluctuations:

1. Seasonal variations.
2. Business cycle trends.
3. Secular, or long-time growth.
4. Erratic changes.

The probable net change in volume will be the net total change of the four individual probabilities.

The first cause of fluctuation in volume may be styled "seasonal variations". They may be defined as those ups and downs in the month to month activity which are caused by the weather, length of months, or trade habits peculiar to the single industry. For such reasons, in one industry, January's order volume will always exceed December's, July's will always be under June's, while December's order volume, just before customer's inventory time, will sag to the extreme low point. Or, expressing the idea otherwise, and conceiving of the impossible "average year," we may reason that for "seasonal" reasons only, January orders should be 30 per cent greater than the average month. This means that *if there are no other* sudden or persistent counteracting influences to vary order volumes, seasonal influences alone will drive January rates higher than December's to at least 30 per cent greater than the average.

Fig. 4 graphs several varying "seasonal" habits, discovered in, and peculiar only to, the particular phases of our business indicated by the titles. The purely seasonal variations of orders contrast sharply with those of billings. In bold relief the orders curve signals jobber "covering" in January, and "hand to mouth" buying in December. These trade habits are justified by the shipments curve of jobber sales to customers, rising sharply in March with the opening of spring, sustaining well through the summer, with a cleaning up in the fall.

Now, in order that we may study the other fluctuations of any series of figures, for instance shipments or charges to customers, it is desirable to eliminate from the actual raw figures an allowance for the effect of this single cause of variation. Fig. 5 shows our shipments experience during a span of pre-war years.

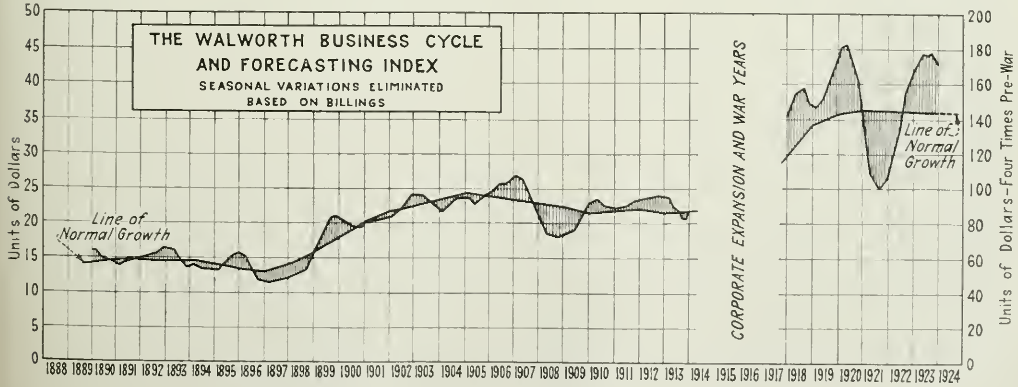


FIG. 6 BUSINESS CYCLE AND FORECASTING INDEX

The up and down curve represents the findings of a preliminary test to discover whether or not there existed consistent cycle movements. There are precise methods for eliminating the effect of seasonal variations only, but for this test case we calculated the continuous one year's moving average of the monthly sales figures. This method roughly eliminates seasonal variations (and many purely erratic variations) because each average point results from the net effect of always 12 calendar months, and of an always maintained assortment of seasonally high months with seasonally low months, this for the purpose of washing out seasonal differences.

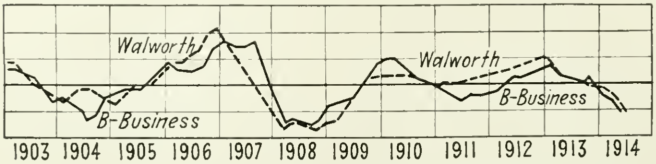


FIG. 7 WALWORTH SALES COMPARED WITH HARVARD CURVE B (BUS.) 1903-1914

Although this particular historical chart indicates clearly the presence of recurring business cycles, it is nevertheless true that, until the present decade, there was a fairly general conception of business as progressing—aside from accidental, erratic fluctuations—in a continuous, straight-line flow determined by the trend of business if all the several variations from the average could be eliminated. Presumably, this average straight-line flow would be gradually upward or horizontal; in some businesses it might be downward. The presence of this secular or long-time growth in the curve of Fig. 5 was indicated by the tendency for each new high point to be higher than the previous high point, and for each new low point to be less low than its previous low point. Obviously, we should not have been able to analyze this cycle action if we did not also eliminate the effect of this secular trend.

Again by a crude device for this test case, we did effectively eliminate the long-time growth by calculating a moving average upon a sixty months'—or five years'—basis, this period being sufficiently lengthy to average out the numerous variations caused by fluctuations in the trend of the business cycle. Calculation was, in this case, made directly from the same series of raw monthly sales figures as had been used for figuring the twelve months' moving average, with the anticipated effect of producing essentially a straight line as shown in Fig. 6. This straight line was then plotted on the graph sheet used for plotting the twelve months' moving average. (In plotting, it was essential, of course, to locate each average point at the center of the period averaged). When this was done it was found that the one year's moving average consistently ran under and then over the five years' average line in about equal and offsetting areas.

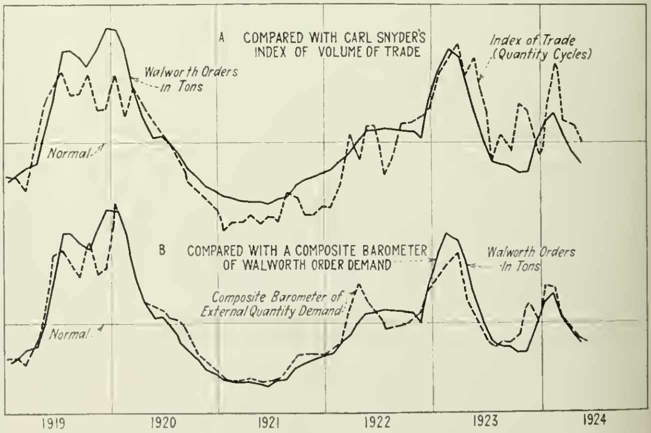


FIG. 8 ORDERS RECEIVED VERSUS RELEVANT INDICES OF VOLUME OF TRADE

To suggest the advantage of even such a crude checkup of an individual cycle, Fig. 7 shows this particular cycle action compared with a cycle curve of relevant external business condition barometers. Of course, the external barometers, too, must be corrected for their particular seasonal and secular influences before they can be compared with other cycle movements.

In the test comparison of Fig. 7, our business cycle line is the one year's moving average of Fig. 6, figured in percentage of the five years' moving average level in the same centered month. On the chart shown, the various percentages are plotted as 10 per cent to one unit for comparison against the Harvard B line, the external business cycle index which most favorably compared then with our own cycle index.

It has already been shown that fluctuations of orders and commitments would naturally precede the fluctuations of shipments; and, further, that quantity demand would indicate a substantial increase before price or value would reflect the existing upturning toward a recovery from depression. Therefore, in searching for a guiding value for budgetary policy, the initial cycle analysis should pertain to the record of monthly orders in terms of quantity or of a fixed "list price," unaffected by price changes. Also for comparison with this the external barometers selected must be either in terms of quantity or of deflated value.

Valuable as pre-war precedents are, it is almost impossible to secure this type of comparison for more than a few such years. The necessary data are not available. Nevertheless, a profit return all out of line with the necessary investment accrues to the administrator who insists upon post-war cycle checking such as shown in Fig. 8.

Putting Orders Through the Shop

Building Tractors Under Scientific Management—V

By GEORGE D. BABCOCK

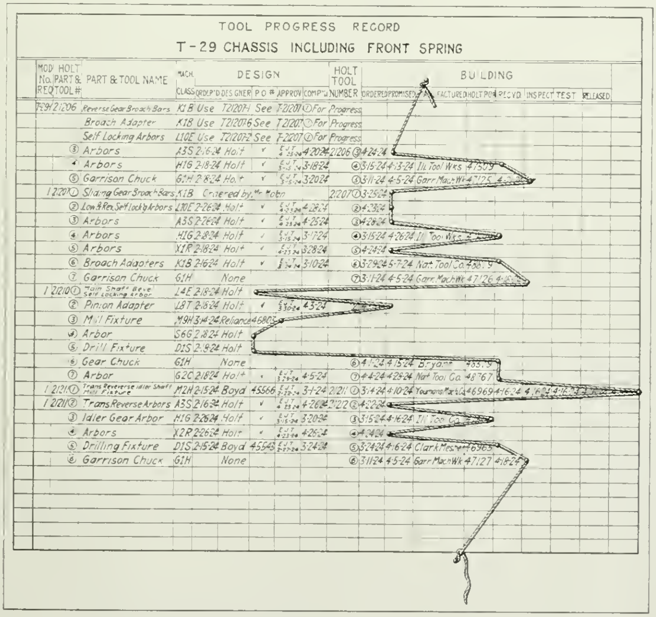
Manufacturing Executive, Holt Manufacturing Company

Index Number
658.5 Production control

ONE feature that has aided materially in obtaining control of the manufacturing operations is the close co-operation between the engineering department, responsible for design, and the route and equipment department, which devises the methods of doing the work in the shops, and which also designs the tools and fixtures.[1] It is a well-known fact in manufacturing that designs frequently get into the shop which are difficult and costly to machine whereas a very slight change in design would make the part a comparatively simple job from the shop standpoint. It is to avoid just such slips as this in the design that the route and equipment department checks up the engineering department's drawings before the work is sent into the shop.

The procedure is as follows: After the general features of the design have been decided, a sketch is forwarded to the route and equipment department. The engineers in this department analyze the job for machine operations, and decide what special tools or fixtures may be necessary. They study ease of machine set-up, attainable machining accuracy, speed, and simplification of design for easier processing. For instance, in a certain design the bosses for two closely adjoining bolt holes required facing. The design as originally made called for a small projection or lug between the bolt holes, thus necessitating spot facing of each boss separately. A slight change in design, suggested by the route and equipment department, removed the lug from between the bolt holes. It was then possible to run a cutter across the bosses and face them in a single machine movement at a great saving in cost.

Another function of the route and equipment department is to determine whether special tools and fixtures can be best made in the Holt Company's toolroom, or best purchased outside. The policy has been generally adopted of buying outside all special tools whenever possible, unless the price quoted is excessive. This serves a double purpose: (1) it puts the tool work in the hands of specialists; and (2) it enables the Holt Company to concentrate on its main business, which is the building of tractors.



TOOL PROGRESS RECORD

T-29 CHASSIS INCLUDING FRONT SPRING

MOD No. REQ	HOLT PART & TOOL #	PART & TOOL NAME	MACH. CLASS	DESIGN					HOLT TOOL NUMBER	BUILDING							
				ORD'D	DESIGNER	P O #	APPROV	COMP'D		ORDERED	PROMISED	FACTURED	HOLT PO #	REC'VD	INSPECT	TEST	RELEASED
T29 1	21206	Reverse Gear Broach Bars	K1B	Use	T21207-1	See	T-21207	① For	Progress								
		Broach Adapter	K1B	Use	T21207-6	See	T21207	⑦ For	Progress								
		Self Locking Arbors	L10E	Use	T21207-2	See	T-21207	① For	Progress								
	③	Arbors	A3S	2-16-24	Holt	✓	E.J.T. 4-23-24	4-20-24	21206	③ 4-24-24							
	④	Arbors	H1G	2-18-24	Holt	✓	E.J.T. 3-15-24	3-18-24		④ 3-15-24	4-13-24	Ill. Tool Wks	47509				
	⑤	Garrison Chuck	G1H	2-18-24	Holt	✓	E.J.T. 3-5-24	3-20-24		⑤ 3-11-24	4-5-24	Garr. Mach. Wk	47125	4-[illegible]			
1	21207 ①	Sliding Gear Broach Bars	K1B	Ordered by Mr. [illegible]					21207	① 3-25-24							
	②	Low & Rev. Self lock'g Arbors	L10E	2-26-24	Holt	✓	E.J.T. 4-23-24	4-28-24		② 4-23-24							
	③	Arbors	A3S	2-26-24	Holt	✓	E.J.T. 4-23-24	4-25-24		③ 4-28-24							
	④	Arbors	H1G	2-18-24	Holt	✓	E.J.T. 3-15-24	3-17-24		④ 3-15-24	4-26-24	Ill. Tool Wks	[illegible]				
	⑤	Arbors	X1R	2-18-24	Holt	✓	E.J.T. 4-23-24	3-28-24		⑤ 4-24-24							
	⑥	Broach Adapters	K1B	2-16-24	Holt	✓	E.J.T. 3-24-24	3-10-24		⑥ 3-29-24	5-7-24	Nat. Tool Co.	[illegible]				
	⑦	Garrison Chuck	G1H		None					⑦ 3-11-24	4-5-24	Garr. Mach. Wk	47126	4-18-[illegible]			
1	21210 ①	Main Shaft Bevel Self Locking Arbor	L4E	2-18-24	Holt												
	②	Pinion Adapter	L8T	2-18-24	Holt	✓	E.J.T. 3-30-24	4-3-24		[illegible]							
	③	Mill Fixture	M9H	3-14-24	Reliance	46803											
	④	Arbor	S6G	2-18-24	Holt												
	⑤	Drill Fixture	D1S	2-18-24	Holt												
	⑥	Gear Chuck	G1H		None					⑥ 4-1-24	4-15-24	Bryant	[illegible]				
	⑦	Arbor	G2C	2-18-24	Holt	✓	E.J.T. 3-29-24	4-5-24		⑦ 4-4-24	4-28-24	Nat. Tool Co.	48767				
1	21211 ①	Trans Reverse Idler Shaft Mill Fixture	M2H	2-15-24	Boyd	45566	E.J.T. 2-22-24	3-1-24	21211	① 3-14-24	4-10-24	Youmans Mach. Co.	46969	4-16-24	4-16-24	4-16-24	[illegible]
1	21211 ②	Trans Reverse Arbors	A3S	2-16-24	Holt	✓	E.J.T. 4-23-24	4-26-24	21212	② 4-22-24							
	③	Idler Gear Arbor	H1G	2-26-24	Holt	✓	E.J.T. 3-15-24	3-20-24		③ 3-15-24	4-16-24	Ill. Tool Co.	[illegible]				
	④	Arbors	X2R	2-26-24	Holt	✓	E.J.T. 4-23-24	4-26-24		④ 4-24-24							
	⑤	Drilling Fixture	D1S	2-15-24	Boyd	45543	E.J.T. 2-27-24	3-24-24		⑤ 3-24-24	4-16-24	Clark Mesner	46965				
	⑥	Garrison Chuck	G1H		None					⑥ 3-11-24	4-5-24	Garr. Mach. Wk	47127	4-18-24			

FIG. 24 CHART FOR RECORDING PROGRESS OF TOOLS PURCHASED OUTSIDE

Equipment that is purchased outside is kept track of in a rather ingenious manner. The chart shown in Fig. 24 lists every tool or fixture that is required in connection with a particular design. It also shows the type of machine for which the tool or fixture is to be designed. The chart has a number of columns relating to design, entitled respectively, "Ordered," "Designer," "Part Order Number," "Approved," and "Completed". In the second group, columns related to the placing of purchase orders are entitled respectively, "Ordered," "Promised," "Manufactured". A third set of columns deals with the delivery of the tools, these columns being entitled "Part Order Number," "Received," "Inspected," "Tested," "Released," and "Delivery Date". As the procedure in regard to each tool or fixture is determined, the name of the contractor to whom the job is awarded is entered in the column headed "Designer". Dates are entered in the appropriate columns when each function in design has been completed. The design having been approved, the specific order for the tools themselves is placed, and the record made by entering the dates of each event in the appropriate column. Similarly when the tools are delivered, they are given a number and the dates of their receipt, inspection, test, etc., are entered in the proper columns.

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[1] See MANAGEMENT AND ADMINISTRATION for June 1924, p. 647; July 1924, p. 19; August 1924, p. 141; September 1924, p. 265.

As each date is entered on the chart a pin is placed at the side of the column in which the date is written. A red string is attached to the top of the chart and is drawn around these pins forming a jagged line extending from the top to the bottom of the chart. When all the tools are finished and accepted this string will form a continuous straight line from top to bottom alongside of the last column. A glance at the chart shows by the position of the string just how much work remains to be done on any lot of tools at any time. Any tools which are lagging are immediately shown up, and pressure can be brought upon the contractor to expedite delivery.

The Scheduling of Orders in the Shop

The route and equipment department also furnishes the data from which the schedules for the manufacturing program are made. The first step is to lay out an operation sheet for each part, on which are listed the various operations necessary, and the sequence in which they occur. Opposite each operation are noted the class of machine to be used, the time required, and the number of days prior to the date on which the part is due in finished parts or worked material stores. This last figure is arrived at by allowing one day for the movement of work between each operation, and one day for each operation, unless the time per piece for a particular operation is greater than one day, in which case the actual number of days would be allowed, fractional parts of a day being considered as one day.

The information on the operation sheet is transferred to the route sheet, which is used both as a guide for dispatching and as a record of completed work. The route sheet has columns for recording the progress of several lots at one time, and as each movement or operation on a group of parts is completed, it is checked off in the appropriate column allotted to the lot to which the group belongs. The date on which each lot is to start is entered on the route sheet opposite the operation, and work orders for these operations are made out and dated accordingly. If information is desired at any time as to the progress of any part in any lot, it is only necessary to ascertain the drawing number of the part. Reference to the route sheet will then show the last completed operation. The checking of route sheets and the issuance of work orders are handled by the dispatch division of the material control department. Fig. 25 shows the forms and routine used for scheduling work. By following the heavy black arrows the relation of the various forms and the entries on them can be readily seen. Thus, the balance of stores sheet controls the quantity and the route sheet the dates on the stores issue sheet. The route sheet is made up from the operation sheet.

Determination of Machine Capacity

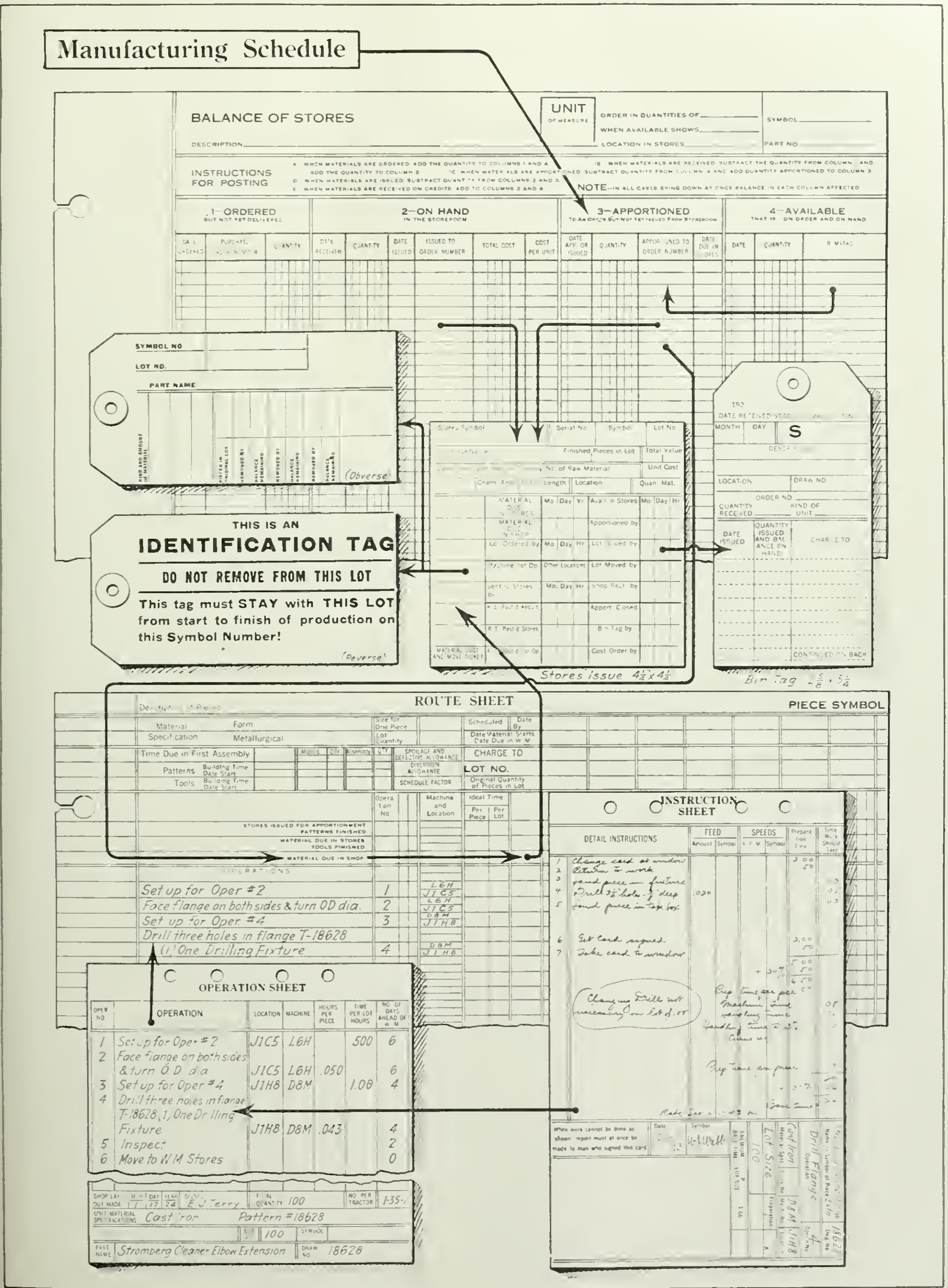
To schedule work accurately it is necessary to know the machine capacity available for each operation on each part, as well as the time required. Otherwise a greater amount of work might be scheduled to a certain machine than it would be able to handle. This contingency is avoided by means of the machine burden record, Fig. 26. The machine burden record is made up from the operation sheets (Fig. 25). Each machine in the shop has allotted to it a burden sheet, and the operations shown on the operation sheets are noted on the burden sheets of the respective machines called for, with a statement of the time in hours. If the total of all the times entered on a burden sheet, multiplied by the number of units of product scheduled for production each day, exceeds the total working hours in the day, the machine is overburdened. If, on the other hand, this product is less than the number of working hours in the day, the difference between the product and the working hours per day represents the capacity available for additional work.

An overburden can be corrected by re-routing, that is, by assigning some of the work to other classes of machines, by running some of the overburdened machines overtime, or by procuring additional equipment. The particular course to be followed depends to some extent on the existing conditions. If the overburden is of temporary character, overtime is the remedy indicated. If it is of permanent character, the second shift of workmen, or re-routing, or the purchase of more machines, usually proves best.

The Fixing of Operation Times

Before schedules can finally be made up, the route and equipment department must have accurate knowledge of the time necessary for each operation on every part that enters into the construction of the tractor. This information is furnished by means of a job analysis, made from a study of drawings by an expert who is thoroughly competent to determine the best method and sequence of operations for a job of machine work.

Cutting speeds are assumed for the different types of machines and classes of work on the basis of experimental work on the various classes of material that are used. Feeds also based on experiments are used that will give a tool-life, without regrinding, of about three hours in connection with the assumed speed. These experiments took as their starting point the slide rules which were developed by Barth in the course of Taylor's experiments on the art of cutting metals. The speed and feed being given, the length of time required to make any part then becomes a



Manufacturing Schedule

BALANCE OF STORES

UNIT OF MEASURE

ORDER IN QUANTITIES OF

WHEN AVAILABLE SHOWS

LOCATION IN STORES

SYMBOL

PART NO

DESCRIPTION

INSTRUCTIONS FOR POSTING

NOTE—IN ALL CASES BRING DOWN AT ONCE BALANCE IN EACH COLUMN AFFECTED

1—ORDERED BUT NOT YET DELIVERED			2—ON HAND IN THE STOREROOM						3—APPORTIONED				4—AVAILABLE THAT IS ON ORDER AND ON HAND		
DATE ORDERED	PURCHASE ORDER NO.	QUANTITY	DATE RECEIVED	QUANTITY	DATE ISSUED	ISSUED TO ORDER NUMBER	TOTAL COST	COST PER UNIT	DATE APPORTIONED OR ISSUED	QUANTITY	APPORTIONED TO ORDER NUMBER	DATE DUE IN OPRS	DATE	QUANTITY	REMARKS

SYMBOL NO

LOT NO.

PART NAME

(Obverse)

THIS IS AN

IDENTIFICATION TAG

DO NOT REMOVE FROM THIS LOT

This tag must **STAY** with **THIS LOT** from start to finish of production on this Symbol Number!

(Reverse)

Stores Symbol — Serial No — Symbol — Lot No

Finished Pieces in Lot — Total Value

No. of Raw Material — Unit Cost

Chem. Anal. — Length — Location — Quan. Mat.

Stores Issue $4\frac{1}{4} \times 4\frac{1}{2}$

DATE RECEIVED

MONTH — DAY — S

LOCATION — DRAW NO

ORDER NO

QUANTITY RECEIVED — KIND OF UNIT

DATE ISSUED — QUANTITY ISSUED AND BALANCE ON HAND — CHARGE TO

CONTINUED ON BACK

Bin Tag $4\frac{5}{8} \times 5\frac{3}{4}$

ROUTE SHEET

PIECE SYMBOL

Material Form

Specification Metallurgical

Time Due in First Assembly

Patterns — Building Time — Date Start

Tools — Building Time — Date Start

CHARGE TO

LOT NO.

STORES ISSUED FOR APPORTIONMENT

PATTERNS FINISHED

MATERIAL DUE IN STORES

TOOLS FINISHED

MATERIAL DUE IN SHOP

OPERATIONS

Operations	Operation No	Machine and Location
Set up for Oper #2	1	L6H J1C5
Face flange on both sides & turn OD dia.	2	L6H J1C5
Set up for Oper. #4	3	D8M J1H8
Drill three holes in flange T-18628		
(1) One Drilling Fixture	4	D8M J1H8

OPERATION SHEET

OPER NO	OPERATION	LOCATION	MACHINE	HOURS PER PIECE	TIME PER LOT HOURS	NO. OF DAYS AHEAD OF W. M.
1	Set up for Oper #2	J1C5	L6H		500	6
2	Face flange on both sides & turn O.D. dia	J1C5	L6H	.050		6
3	Set up for Oper #4	J1H8	D8M		1.00	4
4	Drill three holes in flange T-18628 (1) One Drilling Fixture	J1H8	D8M	.043		4
5	Inspect					2
6	Move to W M Stores					0

SHOP LAYOUT MADE 1 / 17 / 24 E. J. Terry — TOTAL QUANTITY 100 — NO. PER TRACTOR 1-35

UNIT MATERIAL SPECIFICATIONS Cast Iron Pattern #18628

LOT 100 SYMBOL

PART NAME Stromberg Cleaner Elbow Extension — DRAW NO. 18628

INSTRUCTION SHEET

DETAIL INSTRUCTIONS		FEED Amount	FEED Symbol	SPEEDS R.P.M.	SPEEDS Symbol	Prepare Time	Time Work Should Take
1	Change card at window					2 00	
2	Return to work					50	
3	Load piece in fixture						3
4	Drill $3\frac{1}{4}$" hole - $\frac{5}{8}$" deep	.020					05
5	Load piece in tote box						03
6	Get card signed					2.00	
7	Take card to window					50	

+ 30%

5 00

50

6 50

(Changing Drills not necessary on Set of 1.00)

Prep time per piece

Machine time

handling time

Handling time @ 30%

Prep time per piece

When work cannot be done as shown report must at once be made to man who signed this card

Date — Symbol

Lot Size 100

Cast Iron

Drill Flange

D8M J1H8

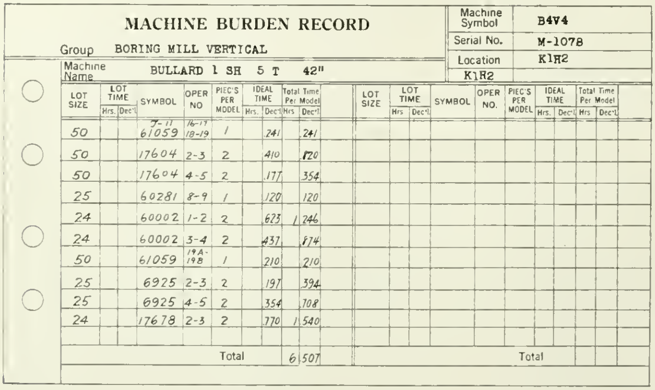
4

18628

Fig. 25 Routine Followed and Forms Used for Scheduling Work

matter of simple slide rule calculation. The time necessary for machine manipulation is estimated from previous jobs and available data on similar work.

The various steps required in the course of a machine operation are set down in great detail, together with the time required for each step. We have thus made an instruction card (Fig. 25), similar to the instruction cards that have been published in connection with treatises on the art of time study. The sum of the times estimated for the various operations, plus the proper allowances, gives the time that should be allowed in making up a schedule.



MACHINE BURDEN RECORD

Group BORING MILL VERTICAL

Machine Name BULLARD 1 SH 5 T 42"

Machine Symbol B4V4

Serial No. M-1078

Location K1R2

K1R2

LOT SIZE	LOT TIME Hrs.	LOT TIME Dec'l	SYMBOL	OPER NO	PIEC'S PER MODEL	IDEAL TIME Hrs.	IDEAL TIME Dec'l	Total Time Per Model Hrs	Total Time Per Model Dec'l	
50			7-11 61059	16-17 18-19	1		.241		.241	
50			17604	2-3	2		.410		.820	
50			17604	4-5	2		.177		.354	
25			60281	8-9	1		.120		.120	
24			60002	1-2	2		.623	1	.246	
24			60002	3-4	2		.437		.874	
50			61059	19A- 19B	1		.210		.210	
25			6925	2-3	2		.197		.394	
25			6925	4-5	2		.354		.708	
24			17678	2-3	2		.770	1	.540	
Total								6	.507	

LOT SIZE	LOT TIME Hrs	LOT TIME Dec'l	SYMBOL	OPER NO.	PIEC'S PER MODEL	IDEAL TIME Hrs.	IDEAL TIME Dec'l	Total Time Per Model Hrs	Total Time Per Model Dec'l	
Total										

FIG. 26 MACHINE BURDEN RECORD

While the instruction card thus made up bears a marked resemblance to the conventional time-study instruction card, it should be emphasized that time study is not used at the Holt plant. Several reasons exist for this. In the first place, there is not the same need today for time study that there was at the beginning of the scientific management movement. There are in existence many detailed time-study data, and from these, accurate estimates can be made of the time to be allowed for practically any machine shop job that can be conceived. Furthermore, when Taylor began his work, machine standardization was an almost unheard-of quantity. Every machine had possibilities different from every other, and every job had to be analyzed with reference to the particular machine in which the work was to be done. Today, machines of the same class and type usually have the same possibilities as regards speeds, feeds, and power available, and their manipulation is largely the same. The time for removing metal can be determined by a simple calculation, based on the feed and speed, and the time for manipulation can be estimated.

A second reason for not adopting time study was the fact that before time study of any permanent value can be made, the shop equipment must be brought up to the ultimate standard at which it is to be maintained. Carl G. Barth has aptly said: "By the time that you have done everything that should be done before you are ready for time study, you will find that you don't need much time study". As we have already indicated, when the establishment of scientific management at the Holt plant was begun, we found enough work to do on the standardization of equipment to occupy our attention for a long time. When this was finished, we had gained so much knowledge of our product and our personnel that estimates could be made of the time required for the different jobs that were as accurate as was commercially necessary.

Another reason for not using time study, although it did not weigh heavily in the scale, was its effect on the personnel. There had been one attempt at scientific management in a neighboring town, in which undue emphasis had been laid on time study, without adequate preliminary preparation. The results were unfortunate and the workers of the district were suspicious of the stop-watch. Since there was much to be done in other directions, there was no necessity for adopting methods which at the outset would only arouse antagonism. As matters have turned out, we have not needed time study. On the other hand, should circumstances indicate it to be desirable, we should not hesitate to use it.

We do not give our instruction cards to the workman. When a job is assigned, the foreman informs the man of the standard time and also of the feed and speed that should be used to attain the standard. If the workman uses the speeds and feeds and exercises reasonable diligence in the manipulation of his machine, he will attain standard time without difficulty. On the other hand, the job times are not set so loosely as to permit any slothfulness on the part of the workman. If he is not diligent, he will very shortly find himself rated as a third-class man, which carries with it a decrease in the hourly wage rate. Furthermore, third-class men are the first to be displaced when it is necessary to reduce the force.

The instruction cards are given to the foreman so that he may familiarize himself with the methods upon which the time allowed for the job is based. If the workman has difficulty in accomplishing his task, the foreman is required to assist and demonstrate, if necessary, the methods called for by the instruction card. The success of this method is shown by the steady and marked improvement in the performance of the men over a considerable period of time. When rates are first put into the shop for jobs which previously have not been rated, protests against them are usually vigorous. The ability to demonstrate that the time is a fair one, coupled with continual pressure brought upon the men to meet the time, usually has the effect of diminishing the resistance rapidly and of bringing third-class operators into the second class, and graduating second-class men into the first class.

No attempt has been made to set rates in the shop in the usual sense. Nevertheless, a standard time is fixed for every job as above explained. This gives the information necessary for making schedules and also for establishing a standard by which the performance of

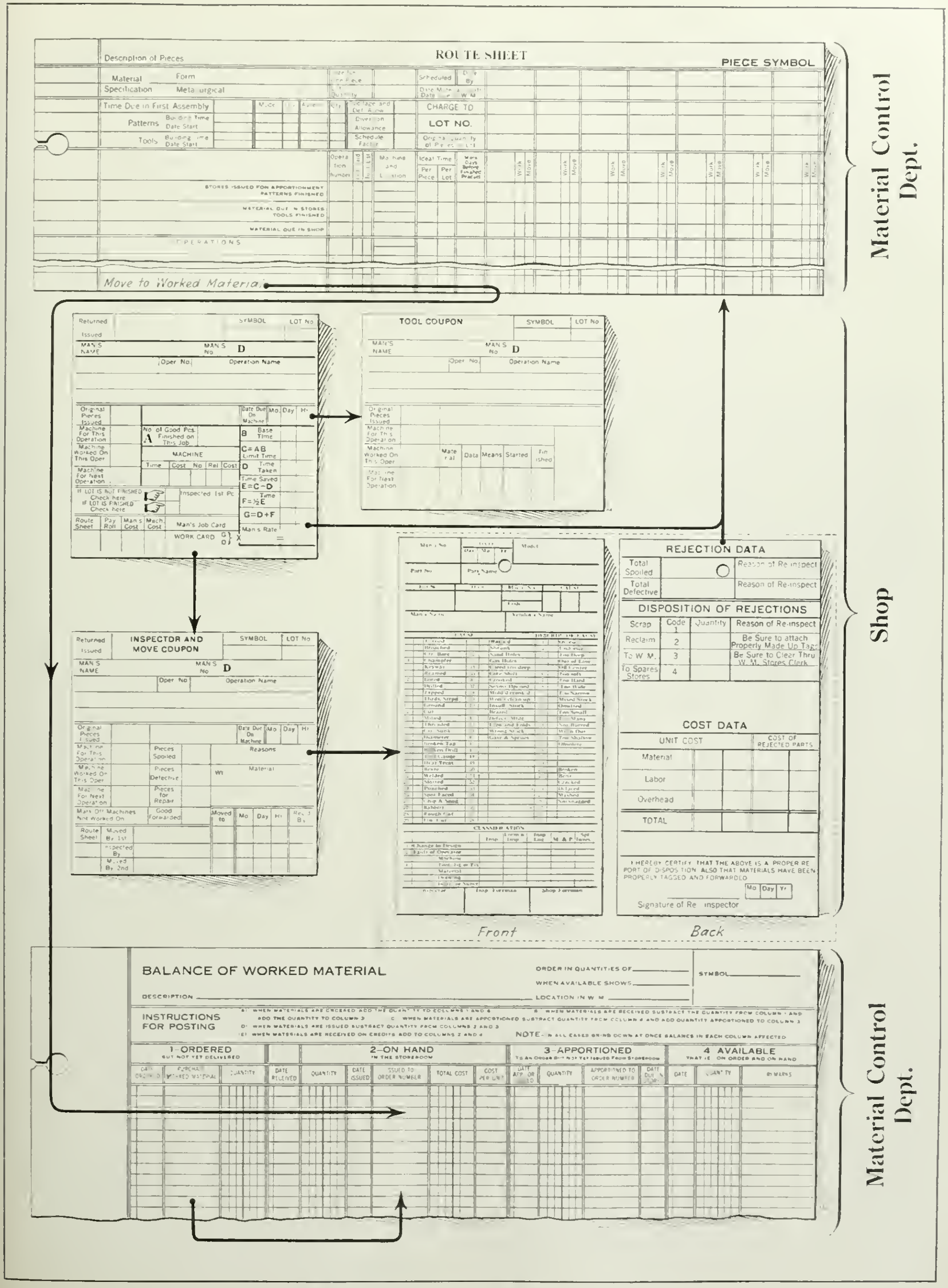

ROUTE SHEET
PIECE SYMBOL
CHARGE TO
LOT NO.
Move to Worked Material
Material Control Dept.
TOOL COUPON
Man's Job Card
WORK CARD
INSPECTOR AND MOVE COUPON
REJECTION DATA
DISPOSITION OF REJECTIONS
COST DATA
Front
Back
Shop
BALANCE OF WORKED MATERIAL
INSTRUCTIONS FOR POSTING
1-ORDERED
2-ON HAND
3-APPORTIONED
4-AVAILABLE
Material Control Dept.

FIG. 27 ROUTINE OF DISPATCHING WORK IN THE SHOP

the men may be judged. As explained previously, men are assigned to one of three classes or grades according to their ability. The hourly wage rate of three classes differs, and this is the only financial incentive offered for fast and accurate work. Whether a man is rated as first, second, or third class depends upon himself, and he is automatically transferred from one class to another by his record in the shop. The net result is a picked body of high-grade men, and an unusually low rate of labor turnover.

The dispatching division is responsible for keeping the shop up to schedule. Dispatching involves four items: moving material to each work place; assigning workmen to the jobs; issuing tools; and assigning inspectors. Fig. 27 shows this routine.

As explained earlier, the route sheet lists the operations which are to be performed on each part. From the route sheet three tickets for each operation are made out, the job ticket, the inspector and move coupon, and the tool coupon. These are dated to show the date on which the operation called for should be performed in accordance with the dates on the route sheets. The three tickets for an operation are clipped together and forwarded to the dispatching division by the material control division.

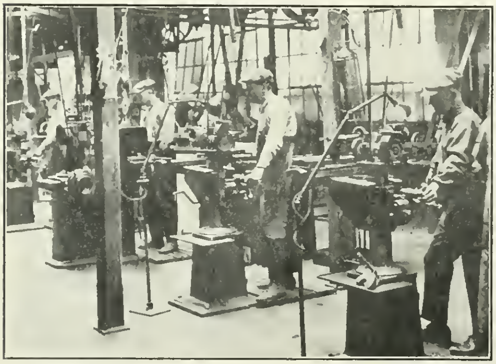


Fig. 28 Tool-Grinding in Tool-Crib

The dispatching division files the tickets until the material for the job arrives on the shop floor from the storeroom. Its movement from the storeroom is controlled by the stores issue tickets issued by the material control department as explained earlier in this series. The first operation is then posted to the class of machine assigned to the particular job as shown by the route sheet. Work is assigned to a class of machines rather than to a particular machine.

When a workman on any of the machines of the class called for by a given job ticket finishes a job, he receives a job ticket that has been posted opposite his name or number in the dispatch racks. This job is one of those for which material has arrived on the floor of the shop, and which is indicated by the date on the job ticket as due to start that day. The move coupon has previously been issued to a move man whose duty it is to move the material to the man's machine. At the same time that the move coupon is issued the tool coupon is sent to the tool crib, which adjoins the dispatch division office, as an order on the tool crib to have the tools needed for the job ready for the workman when he calls for them.

Upon receiving his job ticket, which is time-stamped to show the date and hour of issue, the workman proceeds to the tool crib where he receives the tools previously collected for him and returns to his machine where he finds the material for the job ready. The inspector coupon, which has been returned by the move man as his report that the material has been moved, is then issued to the inspector as an order to inspect the work while it is in process. The inspector proceeds to the machine where the work is being done and remains with the man until he is satisfied that the latter is producing perfect work. Final inspection for workmanship and finish is done in a separate department by a special force.

When the workman finishes his job, he returns the job ticket to the dispatch clerk who again time-stamps it. The difference between the time of issuance and time of return furnishes a basis for computing the cost of the job and also for determining whether or not the workman has attained the standard time set by the route and equipment department. The comparison of the elapsed time and the standard time determines the workman's rating as a first-, second-, or third-class man. Meanwhile, the next job in the operation file for that class of machine has been posted in the dispatch rack as the next job ahead for the workman, and the same routine follows.

Job tickets are in duplicate, the original being given to the workman and the duplicate filed in the dispatch rack to indicate the job upon which the workman is engaged. When the work is completed, the duplicate goes to the cost department for the purpose of figuring costs, while the original is sent to the material control department for the purpose of checking the operations off on the route sheets.

At the Holt Manufacturing Company, all tools of every description are kept in the toolroom. When the route and equipment department makes up its operation sheets for the various operations it, at the same time, makes a list of all the tools required for that operation. This tool list carries the symbol of the part and the operation number. The lists are filed in the tool crib, according to part symbols, and when the tool coupon bearing a particular part symbol and operation number is received in the tool crib the list is removed from the files and the tools called for by it are collected in a tote box ready for the workman. When the job is finished, the workman returns the tools which are inspected and all those needing repairs are sent to the toolroom, while cutting tools are forwarded to the grinding-room in the tool crib for grinding before being returned to the tool racks. (See Fig. 28). The tool coupon is filed in an envelope together with the tool list and the workman's tool check, indicating his responsibility for the return of the tools listed. Upon the return of the tools, the check is given back to the workman, the tool list is filed, and the tool coupon destroyed, for it is of no value as a record.

Visualizing Budgetary Control

Planning Operations to Make a Profit

By EDWARD H. TINGLEY

Delco-Light Company

Index Number
658.14 Financial control

BUSINESS can never be reduced to a machine-like operation. The human element will ever be present and will provide the uncertainty and the interesting feature in all transactions. The psychology of buying and selling will always be effective and the power of personalities will influence the final result. No one would wish it otherwise, for men enjoy the gambling feature of business and the power to influence other men.

The control of business means the control of men and the molding of their thoughts and actions. The success of a manager is gaged by his ability to have a group of capable men around him who will accept his leadership and execute his wishes. But it is necessary that he prove his ability to lead.

Objectives of a Business Leader

Men will follow a leader when they realize that he has a plan of action and a definite goal in mind. All that he does fits into the full scheme and makes others confident of his ultimate success. He plans the business a year ahead and puts the plans down in black and white. His policies are carefully thought out and based on sound economics. He eliminates the element of chance, caused by ignorance, entirely from his operations. He has but one aim for the entire business—a substantial profit on the money invested. He makes each division head responsible for carrying out the plans to the fullest extent, and for co-operating with the other divisions so that by proper methods of organization and economy a profit can be realized from the efforts expended.

The problem of securing a profit necessitates the study by some person of all the factors that enter into the engineering design, selling, and advertising requirements, the financial needs, and the items of labor, materials, and expenses of production. Every business organization, whatever its size, should have some person who knows enough about its internal operation to be able to compile the necessary data of income and expenses for all divisions. He must also analyze reports and facts which he secures from various sources, to be able to give the general manager a "picture" of the business at any time. He should also know the external conditions that are reflected in the operations of the sales and advertising departments and be able to suggest a course of action to the manager. In large companies, such a person is called a comptroller.

The modern comptroller must do more than report on the financial results of the business, for his responsibility includes the analysis of the expenses and the results attained by all divisions to determine if the money has been most effectively used for the greatest profit and ultimate good of the company.

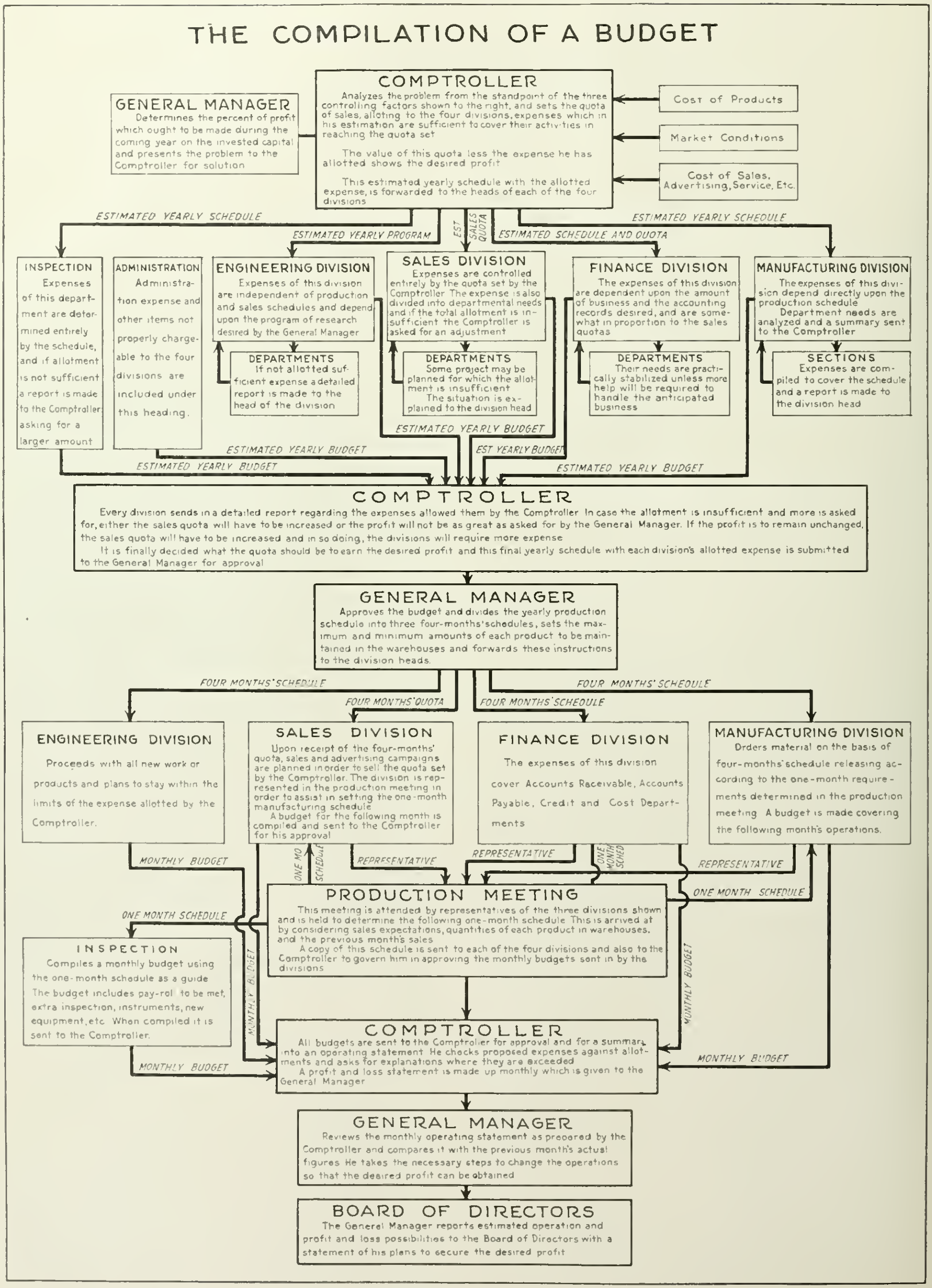
From his knowledge of the details, he is the one best fitted to make an allotment of expenses for a future period; to set sales quotas that the sales division is capable of attaining; to determine production schedules that will tie in with sales possibilities and be most economical from a manufacturing point of view; to allot amounts for advertising and service expenses and for administrative and engineering requirements. In making up the above schedule and expense allotments, he has in effect made a budget of the business, for a budget is nothing more than the determination of the probable net profit from a business when future production is planned, expenses of each division allotted in due proportion and balance, and a certain amount of the product is sold at a profitable price. This budget, subject to the approval of the manager, can be given the executive head of each division, who has the problem of so operating as to produce the results demanded with expenses kept within the limitations established.

To the individual is given the budget to make it effective, and co-operating individuals within a business make a successful organization. Budgetary control, then, resolves itself into taking the necessary steps to secure the desired amount of profit, through the checks and limitations placed upon the operating executives.

There are three distinct parts to management. First, *planning*. This is the part that usually falls to the manager, for he must always be looking ahead and be a step in advance of the actual conditions. Second, *executing*. This is the function of the division heads, who put into effect the details of the manager's plan. Third, *checking*. Very frequently little checking is done to ascertain the results of the execution of the plans until the close of the year, when it is often too late to avert serious financial trouble. The comptroller should report regularly and continuously on the results attained to enable the manager to direct operations.

Major Benefits of a Budget

A business that is planned, executed, and checked by capable executives is very likely to succeed. A good organization is a prerequisite to a successful budget, for after all if good plans are not well executed, they are worthless. The major results and benefits to be obtained from the operation of a business on a budget basis may be summed up in the following manner.



THE COMPILATION OF A BUDGET

GENERAL MANAGER
Determines the percent of profit which ought to be made during the coming year on the invested capital and presents the problem to the Comptroller for solution

COMPTROLLER
Analyzes the problem from the standpoint of the three controlling factors shown to the right, and sets the quota of sales, alloting to the four divisions, expenses which in his estimation are sufficient to cover their activities in reaching the quota set

The value of this quota less the expense he has allotted shows the desired profit

This estimated yearly schedule with the allotted expense, is forwarded to the heads of each of the four divisions

Cost of Products

Market Conditions

Cost of Sales, Advertising, Service, Etc.

INSPECTION
Expenses of this department are determined entirely by the schedule, and if allotment is not sufficient a report is made to the Comptroller asking for a larger amount

ADMINISTRATION
Administration expense and other items not properly chargeable to the four divisions are included under this heading.

ENGINEERING DIVISION
Expenses of this division are independent of production and sales schedules and depend upon the program of research desired by the General Manager

DEPARTMENTS
If not allotted sufficient expense a detailed report is made to the head of the division

SALES DIVISION
Expenses are controlled entirely by the quota set by the Comptroller The expense is also divided into departmental needs and if the total allotment is insufficient the Comptroller is asked for an adjustment

DEPARTMENTS
Some project may be planned for which the allotment is insufficient
The situation is explained to the division head

FINANCE DIVISION
The expenses of this division are dependent upon the amount of business and the accounting records desired, and are somewhat in proportion to the sales quotas

DEPARTMENTS
Their needs are practically stabilized unless more help will be required to handle the anticipated business

MANUFACTURING DIVISION
The expenses of this division depend directly upon the production schedule
Department needs are analyzed and a summary sent to the Comptroller

SECTIONS
Expenses are compiled to cover the schedule and a report is made to the division head

COMPTROLLER
Every division sends in a detailed report regarding the expenses allowed them by the Comptroller In case the allotment is insufficient and more is asked for, either the sales quota will have to be increased or the profit will not be as great as asked for by the General Manager. If the profit is to remain unchanged, the sales quota will have to be increased and in so doing, the divisions will require more expense

It is finally decided what the quota should be to earn the desired profit and this final yearly schedule with each division's allotted expense is submitted to the General Manager for approval

GENERAL MANAGER
Approves the budget and divides the yearly production schedule into three four-months' schedules, sets the maximum and minimum amounts of each product to be maintained in the warehouses and forwards these instructions to the division heads.

ENGINEERING DIVISION
Proceeds with all new work or products and plans to stay within the limits of the expense allotted by the Comptroller.

SALES DIVISION
Upon receipt of the four-months' quota, sales and advertising campaigns are planned in order to sell the quota set by the Comptroller. The division is represented in the production meeting in order to assist in setting the one-month manufacturing schedule
A budget for the following month is compiled and sent to the Comptroller for his approval

FINANCE DIVISION
The expenses of this division cover Accounts Receivable, Accounts Payable, Credit and Cost Departments

MANUFACTURING DIVISION
Orders material on the basis of four-months' schedule releasing according to the one-month requirements determined in the production meeting A budget is made covering the following month's operations.

PRODUCTION MEETING
This meeting is attended by representatives of the three divisions shown and is held to determine the following one-month schedule This is arrived at by considering sales expectations, quantities of each product in warehouses, and the previous month's sales
A copy of this schedule is sent to each of the four divisions and also to the Comptroller to govern him in approving the monthly budgets sent in by the divisions

INSPECTION
Compiles a monthly budget using the one-month schedule as a guide The budget includes pay-roll to be met, extra inspection, instruments, new equipment, etc When compiled it is sent to the Comptroller.

COMPTROLLER
All budgets are sent to the Comptroller for approval and for a summary into an operating statement He checks proposed expenses against allotments and asks for explanations where they are exceeded
A profit and loss statement is made up monthly which is given to the General Manager

GENERAL MANAGER
Reviews the monthly operating statement as prepared by the Comptroller and compares it with the previous month's actual figures He takes the necessary steps to change the operations so that the desired profit can be obtained

BOARD OF DIRECTORS
The General Manager reports estimated operation and profit and loss possibilities to the Board of Directors with a statement of his plans to secure the desired profit

FIG. 1 STEPS IN PLANNING AND COMPILATION OF A BUDGET FOR A MANUFACTURING COMPANY

1. It assures planning ahead and projecting all operations in all divisions of the business on a basis that will assure a reasonable chance to secure the profit desired.
2. Centralized executive control is secured over the internal operations of the business.
3. It emphasizes the need of good organization and tends to demand its continuance as an assurance that the budget plans will be carried out.
4. Sales and production plans can be co-ordinated with financial resources.
5. The uneven sales demand can be kept out of the production schedules so that continuous operation at a predetermined rate will result in greater regularity of employment and in reduced costs.
6. Operating efficiency will be increased by the definite assignment of responsibility for expenditure, by the use of wage payments based on results, and by the maintenance of a steady flow of production in all departments.
7. Processes, equipment, and the product can be simplified and standardized.
8. The inventory of raw and finished materials can be kept at the minimum, thereby permitting increased rates of turnover of the money invested in materials, with resultant increase in profits.
9. Costs can be used for the purpose of control rather than as historical information.
10. The possibility of any one division destroying the profits by unauthorized expenditures is prevented.
11. The financial division is better able to provide the necessary cash for wages of employees and invoices for materials purchased.
12. More economic operation of the business is secured as an opportunity is given to study expenses proposed before they are actually incurred.
13. Every part of the organization is given a definite goal for attainment.
14. The budget serves as a measuring stick to compare the standards and promises with the actual performance, showing not only what is possible but what must be done.

In a large manufacturing company which for years has been operating on a budget basis, a series of charts has been made showing the steps in the compilation of the budget and the details of the organization and system. Only one of these charts, Fig. 1, is shown in this article, but the idea will be easily grasped. This visual method of presentation brings out clearly the few fundamental steps underlying the whole scheme, and definitely states the responsibilities of both manager and executives in carrying it out. The tiresome element of detail is omitted so that the real worth of the plan is quickly appreciated.

Make-up of the Chart

The chart shown in this article is printed only in black, but in actual practice different colored cards are used to represent different departments or divisions. The same colored card for a department is retained throughout all the charts so that it can readily be seen how frequently a department enters into the operations and when. The colors also make the chart interesting and attractive, thereby securing a careful reading by those who should know the methods shown on it.

The chart shown in this article discusses the compilation of the budget, giving the few general steps that are taken to gather the details and allot the schedules of production and expense. A study of it will reveal the three parts of management. In the *planning* the general manager, comptroller, and division executives determine on the future operations to secure the desired profit. The attempts to live within the budget allotments, while *executing* the plans, are shown. The *checking* is obtained from the reports made by the comptroller to the manager and executives, showing a comparison of the actual production and expenses, and the budget quotas and allowances. The budget system requires that all three steps be regularly taken (once a month according to methods shown) in consequence of which there is a safeguard thrown around that business which has a budget. It is a satisfaction to the executives to know so frequently (each month) how their efforts at economical operaation are succeeding, and their relation to the rest of the business as regards quotas, production, and profit.

Planning the Budget

The steps in the planning and compilation of the budget are as follows:

GENERAL MANAGER

Determines the per cent of profit which ought to be made during the coming year on the invested capital and presents the problem to the comptroller for solution.

COMPTROLLER

Analyzes the problem from the standpoint of the three control factors—cost of production, market conditions, and cost of sales, advertising, service, etc.—and sets the quota of sales, allotting to the four divisions expenses which in his estimation are sufficient to cover their activities in reaching the quota set. The value of this quota, less the expenses which he has allotted, shows the desired profit.

This estimated yearly schedule, with the allotted expenses, is forwarded to the heads of each of the four following divisions:

Engineering Division. The expenses of this department are independent of production and sales schedules and depend upon the program of research desired by the general manager.

Sales Division. Expenses are controlled entirely by the quota set by the comptroller. The expense is also divided into departmental needs and carefully analyzed.

Finance Division. The expenses of this division are dependent upon the amount of business and the accounting records desired, and are somewhat in proportion to the sales quotas.

Manufacturing Division. The expenses of this division depend directly upon the production schedule, and departmental needs are analyzed and summarized in the budget.

Each department of the above four divisions analyzes its needs in conjunction with the allotment made by the comptroller, and reports to its division head.

ADMINISTRATION

Administration expense and other items not properly chargeable to the four divisions are included under this head.

INSPECTION

Expenses of this department depend entirely on the production schedule, and, if the allotment is not sufficient, a request is made to the comptroller for a larger amount.

COMPTROLLER

Each division sends in a detailed report regarding the expenses allotted it by the comptroller. In case the allotment is insufficient and more is asked for, either the sales quota will have to be increased or the profit will not be so great as asked for by the general manager. If the profit is to remain unchanged, the sales quota will have to be increased, and in so doing, the divisions may require more expense. It is finally decided what the quota should be to determine the desired profit and this final yearly schedule, with each division's allotted expense, is submitted to the general manager for approval.

GENERAL MANAGER

Approves the budget and divides the yearly production schedule into three four-months' schedules; sets the maximum and minimum amounts of each product to be maintained in the warehouse, and forwards these instructions to the division heads.

Engineering Division. Proceeds with all new work or products and plans to stay within the limits of the expense allotted by the comptroller.

Sales Division. Upon receipt of the four-months' quota, sales and advertising campaigns are planned in order to sell the quota set by the comptroller. The division is represented in the production meeting in order to assist in setting each one-month's manufacturing schedule. A budget for the following month is compiled and sent to the comptroller for his approval.

Finance Division. The expenses of this division cover accounts receivable, accounts payable, credit and cost departments, etc., and are compiled into the monthly budget.

Manufacturing Division. Orders material on the basis of four-months' schedule, releasing according to the one-month's requirements determined during the production meeting. A budget is made covering the following month's operations.

PRODUCTION MEETING

This meeting is attended by the representatives of the sales, finance, and manufacturing divisions and is held to determine the following one-month's schedule. This is arrived at by considering sales expectations, quantities of each product in the warehouse, and the previous month's sales. A copy of this schedule is sent to each of the four divisions and also to the comptroller to govern him in approving the monthly budget sent in by the divisions.

INSPECTION

Compiles a monthly budget using the one-month's schedule as a guide. Budget includes pay-roll to be met, extra inspection instruments, etc. When completed it is sent to the comptroller.

COMPTROLLER

All budgets are sent to the comptroller for approval and for a summary into an operating statement. He checks proposed expenses against allotments and asks for explanations where they are exceeded. An estimated profit and loss statement is made up monthly which is given to the general manager.

GENERAL MANAGER

He reviews the monthly operating statement as prepared by the comptroller and compares it with the previous month's actual figures. He takes the necessary steps to change operations so that the desired profit can be obtained.

BOARD OF DIRECTORS

The general manager reports estimated operations and profit and loss possibilities to the board of directors with a statement of his plans to secure the desired profit.

Results of Budgetary Control

Every executive who operates under budgetary control must naturally come to appreciate the true value of a planned future and the business-like operation of his every-day functions. It also makes him a better business man and forces him to think logically and consistently along lines of profit for the company. Budgets enforce economy, and every expenditure is carefully weighed beforehand. The business is kept balanced and no one division profits at the expense of the other. Co-operation and group responsibility are engendered, and teamwork so essential to success is secured.

Some will doubt the ability of the budget system to work when the important result to be obtained—profits—hinges directly upon the most uncertain of facts—the amount of sales. The system of budget control discussed in this article is based fundamentally upon the disposal of the product—the amount of sales determining how much work the factory will produce during the coming budget period, and what expense will be entailed to replace the product sold. When the sales division gives in its estimate of the sales for the future period, the figures are based on a careful study and keen analysis of the possible future market. Naturally the sales division must not overestimate the market, and must make every effort to sell what it has estimated. The history of many a successful business shows that sales can be made when backed up by a determination to win, and quotas can be met when the right spirit pervades the selling force. The sales organization must realize the purpose of the budget and co-operate to make it a success.

Budget a Chart and Compass

The use of the budget and the control of the organization through the data collected may be compared to the operation of a boat. The budget is the setting of the ship on a definite course, determined in advance with the certainty that thereby a known destination will be arrived at. The control of the divisions of the factory is like the action of the pilot of the ship, whose business is to keep the prow of the boat in the direction previously determined. The budget is his chart and the balance sheet his compass. The compass definitely proves that the business is being piloted in the predetermined channel for the desired profit. Everyone realizes that the safety and life of any business depend on the ability of the "pilot" to steer safely into the "port" of profit.

Conveyors Handle Chewing Gum

System in the William Wrigley Jr. Company Chicago Plant

By W. B. RANNEY

Mechanical Superintendent, Wm. Wrigley Jr. Company

THE low price and small margin of profit at which practically all manufactured articles of daily consumption are sold have been made possible by large-scale production and selling. Mass production has brought about reduced manufacturing costs, and the benefits of the savings have been passed along to the consumer. In the reduction of manufacturing costs the use of mechanical handling equipment has played a very important part.

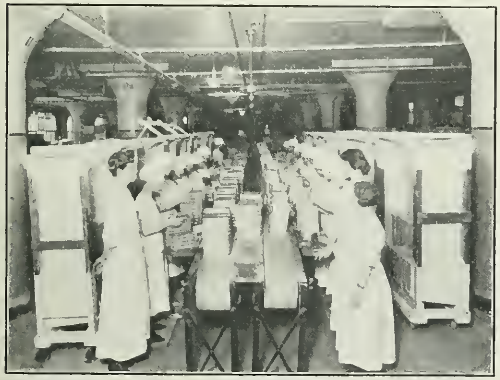


FIG. 1 INSPECTING PACKAGES OF CHEWING GUM
The belt-conveyor carries inspected boxes to a band-sealing machine.

The economies of mechanical equipment are especially marked in the making of such products as chewing gum. Although the retail price of a package of gum is only 5 cents, Wm. Wrigley Jr. Company has an annual business turnover of more than $30,000,000. The profit on each package sold is, however, fractional, but to insure that a profit will actually be made, careful study for the adoption of labor-saving and cost-reducing production methods has been an absolute essential.

In the actual making of chewing gum from its basic ingredient, chicle, handling equipment is extensively employed. From the storage-rooms this material is carried on trucks to the machines which grind and sift it. Then, after going through boiling, drying, melting, and mixing processes, in which corn syrup, cane sugar, and flavoring extracts are added, the chicle, now finished gum, is fed through automatic machines which roll it into sheets and score these sheets in single sticks or in P. K. form.

Index Number
658.281 Mechanical handling

A special handling device receives the sheets from the scoring machine. The sheets of gum fall on a series of wood pallettes, each placed on a little moving truck. After a certain number of sheets have fallen on a pallette it is removed, and replaced by an empty one.

As the filled pallettes are taken off they are stacked on lift platforms. Electric lift-trucks take these platforms to a storage-room where they remain until the gum is needed by the wrapping department.

Automatic machines, each with a capacity of 300,000 pieces per day, wrap the individual sticks of gum first in waxed paper, then in a printed label, and finally assemble five sticks into a package covered with waxed paper and an outer wrapper. They are then ready for packing into cartons.

Up to the operation of rolling gum into sheets and delivering it to the scoring machine and from thence to the pallettes, manufacturing and handling operations involved in making P. K. Chewing Sweets are the same as those for the stick product. But from this point on a different process is followed.

First, the gum is shaped by machines into the familiar P. K's. Then these nuggets are put into large kettles with a charge of candy syrup. The kettles rotate and cover the gum pellets with a coating of the syrup. As one coat solidifies another is applied until the pellets are thoroughly encased in a smooth, firm, uniform, tasty jacket of sweetness.

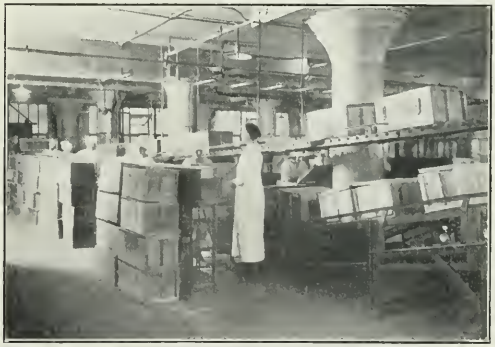


FIG. 2 LOADING THE PACKAGES INTO CASES
Gravity-roller conveyors deliver the empty wirebound boxes and slat-conveyors remove them when filled.

When the coating process is completed the finished P. K's go to the wrapping department. Here automatic machines are again employed. These machines take the pellets, ten at a time, and wrap them in waxed paper, which is heat-sealed to form a firm, air-tight package. A printed label fastened by the machine around the package completes the process. The gum is then packed in cartons.

The cartons of stick and P. K. gum from the automatic wrapping machines are delivered to the inspection department by means of large wood trucks on which they are stacked as filled. These trucks are between 5 and 6 feet high and hold about 1100 cartons each. Fig. 1 shows a view of the inspection department with the trucks back of the rows of girls on each side of the working table.

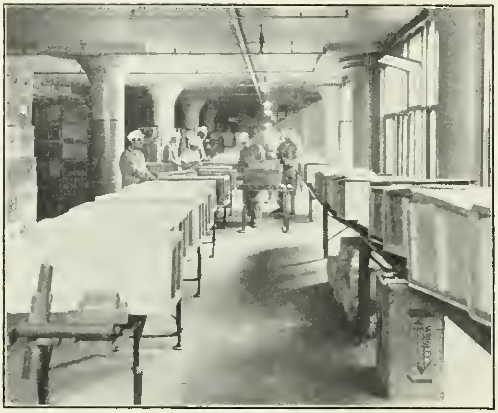


FIG. 3 SEALING THE FILLED CASES

A gravity-conveyor handles the boxes to and from this operation.

Inspection consists of opening the boxes to see that the wrappers on the packages are intact and that the proper quantity is in each carton. When 10 boxes have been inspected the girl places them in a pile on the belt-conveyor in front of her. This conveyor moves intermittently and carries the boxes to a machine where each is sealed with a band.

From the sealing machine boxes are carried on a belt-conveyor into another department where girls place them in shipping cases, 100 cartons to each case. Fig. 2 illustrates the performance of this work. Empty cases are delivered by the gravity-conveyor shown as the upper line in Fig. 2. Filled cases, which weigh 125 lb. each, are placed on the lower conveyor shown in the illustration and are carried to the booster section in the foreground. Here they are elevated to a gravity run which delivers them to the case sealers.

In Fig. 3 the conveyor at the right is the one leading from the packing-room, as above described. The inclined gravity section discharges to a horizontal roller section alongside of the workmen further down the room. The cases are rolled off the main run by the men and set on the short roller sections in the aisle. Here they are nailed shut and then wirebound. After this they are placed on the conveyor at the left. Following an inspection and checking they are sent on their way by means of this conveyor, to the rear of the room, and thence to the shipping department or storeroom.

Shipments in Carload Lots

Many shipments are made in carload lots of a single kind of chewing gum. From the sealing operation such cases are sent by conveyor to the shipping department and from thence to the car. A portion of the system leading to the shipping department is shown in Fig. 4. From the gravity run at the left in the previous illustration the cases are fed to the elevating section in Fig. 4. They are picked up by the combination bar and chain mechanism of the elevator and discharged to another gravity-conveyor. This takes them down the room to the left of the picture. The section at the rear is utilized when it is desired to shunt cases into temporary storage. To the right in the picture may be seen knocked-down cardboard boxes and one of the trucks, similar to those in Fig. 1, used to carry these boxes to the filling department.

The lower run in Fig. 5 shows another section of the conveyor leading from the elevator in Fig. 4. Here the cases make a turn and pass out of the building into a covered gravity run, down which they go directly into a railroad car. The steel lift-door at the left of the picture closes off this run when it is not in use. As the cases make the turn they are numbered consecutively by means of a hand numbering machine. In the foreground is shown a conveyor used when it is necessary to store the cases for a time in this room as they are delivered down the incline from the other department.

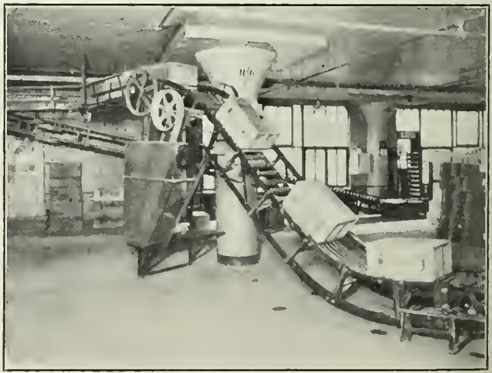


FIG. 4 A CONVEYOR ELEVATOR LIFTS THE CASES FOR A GRAVITY RUN TO THE SHIPPING DEPARTMENT

A gravity shunt to storage is shown in the background.

The upper conveyor running along the windows in Fig. 5 handles cases not yet sealed. It is sometimes necessary to run such cases into storage, and this conveyor is utilized for the purpose.

Gravity-Conveyor Storage System

One of the most interesting portions of the conveyor system is that connected with a section of the storage-

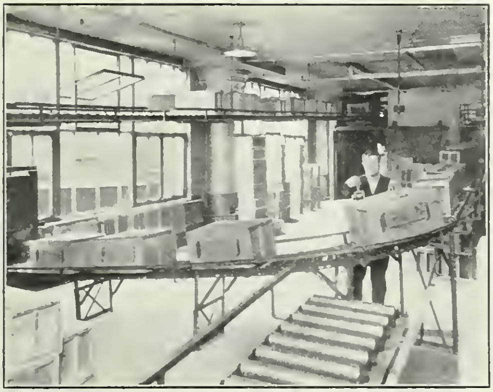


FIG. 5 CASES ON THE WAY TO THE RAILROAD CAR
The upper conveyor is a gravity line taking cases to storage.

room for cases ready to ship. This department handles all orders for chewing gum where shipment is less than carload lots of a single variety, but where individual cases are not made up of assortments. Fig. 6 shows a view of the department. At the far end of the room is a conveyor leading from the case sealing department and running perpendicular to the lines of cases in the photograph. As cases are delivered by this rear conveyor a man shunts them off to the correct one of the cross-conveyors.

Each of these lines of cross-conveyors handles but one variety of product. Signboards with the names of the various brands of chewing gum are nailed to the beams above the conveyors as the illustration shows. The construction is of the gravity-roller type, and the rear end of each line is elevated so that cases feed down by their own weight. At the front end of each conveyor there is a bar stop to hold the line of cases in place. Along the front end is a level receiving line onto which each of the cross lines feeds.

When a shipment is to be made, one of the order clerks passes along in front of the receiving-conveyor. He presses a foot lever below the conveyor from which he wishes to take cases for shipment, and this lowers the stop bar. The line of cases starts discharging on the cross-conveyor. As each one is delivered the order clerk swings it around and starts it down the conveyor toward the left. When the desired number of cases has been taken, he raises the foot lever and shuts off the rest from following. Then, going to other lines, he completes his order by a similar process.

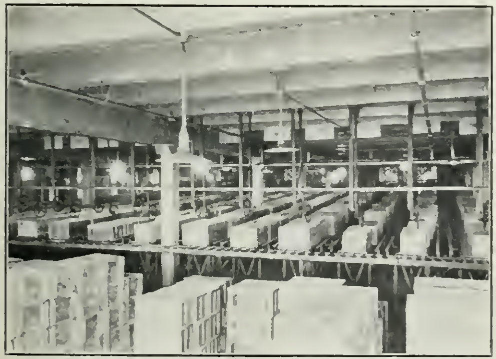


FIG. 6 GRAVITY STORAGE FOR QUICK AND LOW-COST MAKING UP OF ORDERS
These gravity-conveyors act as a great "classification yard." Boxes are run off as wanted by merely pressing a foot lever.

The level conveyor thus serves as an assembling point for this class of orders. The left-hand end of the conveyor carries the cases to a scale for determination of the shipping weight. From this point they proceed to the stenciling operation.

The method of storage just described is unusual. It will undoubtedly appear on first thought to be unnecessary and costly. The investment in equipment is large. Because only one row of cases can be put on each conveyor and clearances between conveyors are required, the installation certainly does not utilize a maximum of storage space vertically or horizontally. Maintenance and repair charges on the apparatus can be left out of the question as they are a mere trifle. The equipment does not break down in service. But certain case goods must be piled in storerooms for a time, and why should this large shipping center be made an exception?

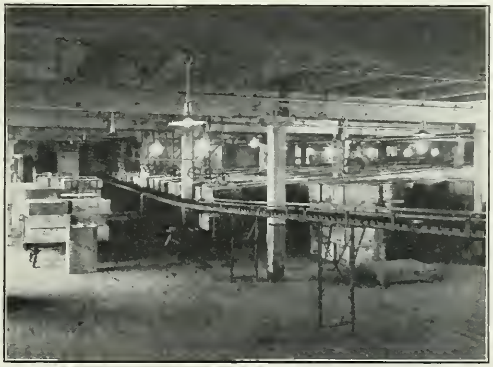


FIG. 7 VIEW ACROSS THE GRAVITY-STORAGE ROOM
The conveyor across the front of the storage lines delivers the cases to the shipping department.

The installation was made only after careful cost analysis had definitely proved the economy of the method adopted. The "classification yard" plan followed in the storeroom for case goods of a varied nature saves so much in handling time and expense and enables shipments to be sent out with such speed, that its total operating cost is far less, even with interest charges on investment and rent on space included, than wages of helpers needed where ordinary storeroom methods are employed.

A view across the classification storeroom is given in Fig. 7. The inclined conveyors feeding onto the cross-conveyor, and a gravity portion of the latter coming from another storeroom, are shown.

After being weighed, the cases go to the stenciling department. Fig. 8 is a view of this section which is located in the far corner of the storeroom in Figs. 6 and 7. To the right in Fig. 8 is shown the upper end of one of the classification conveyors. Above, in the background, is the feeder conveyor which supplies cases to the classification yard. In the foreground is a row of cases on the conveyor leading from the front of the classification conveyors.

The cases shown here are ready for shipment. They are being stenciled with the name of the customer and the destination. After this is done they are pushed to the end of the room where, just back of the man holding the stencil brush, there is a spiral chute leading to the floor below.

Down this chute they go, landing on the gravity-conveyor shown in Fig. 9. Here they make a right-angle turn and go out through the opening in the wall into a freight car for shipment.

Not all the cases which are shipped are filled with only one kind of gum. Many orders call for a miscellaneous assortment. The packing of such lots is shown in Fig. 10. To the far right are seen the small boxes of chewing gum of various kinds. These are used to fill orders for a variety of products. When the lots are made up and put in the cases they are conveyed to the workmen at the center of the room. Here the cases are bound with metal strapping which is nailed in place and then crimped at the joint. The cases are finally sent to the shipping-room by roller-conveyor.

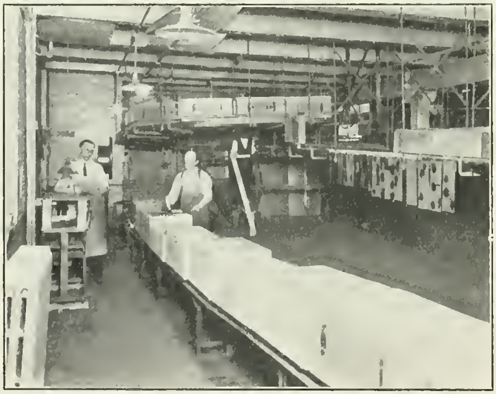


FIG. 8 STENCILING CASES FOR SHIPMENT
A spiral chute at the rear carries them to the floor below.

As is evident from the description given of the packing and shipping operations in the plant, very little hand labor is involved in moving about the packages and cases of chewing gum. Wherever possible, conveyor apparatus has been used. But the plant is not "over-conveyored". Before each part of the system was laid out careful calculations were made to determine the relative cost of handling under both hand and mechanical methods. Where conveyors were installed the work was done with a full knowledge of their ultimate economy in saving time, labor, money, and trouble, and in order to assure profit in the manufacture of an article of daily consumption that sells for a low price in a competitive market.

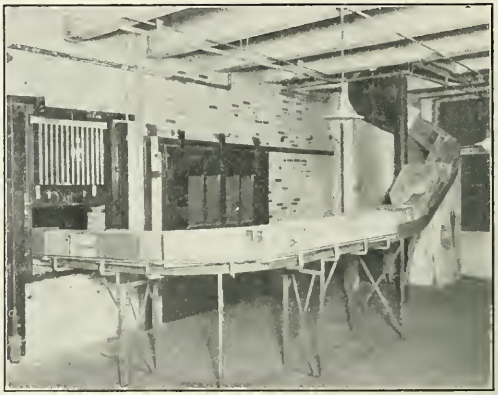


FIG. 9 SHIPPING CASES OF CHEWING GUM
After cases are stenciled they are sent to the railroad car on gravity-conveyors.

Throughout all the manufacturing and handling processes involved in the making of chewing gum, one problem is involved which enters prominently into certain industries—the necessity for keeping the temperature and humidity of the air within definite limits.

Chewing gum is especially susceptible to these two factors. Hence the success of all manufacturing and handling operations depends to a great extent upon conditioned air. Special care must be taken during the drying process to eject the moisture given off. Rolling and scoring, and incidental conveying must be done in rooms to which air of the right temperature and moisture content has been supplied. To and from, and in storage, the gum would either soften up or dry out in an unprepared atmosphere. Wrapping and packing also require clean, conditioned air. After the gum is packed, of course, it is safe from the weather.

If air conditions were not kept correct by mechanical means at any of these points, operations both of automatic machinery and handling equipment would be cut down to a fraction of the full capacity and quality could be preserved only with great difficulty.

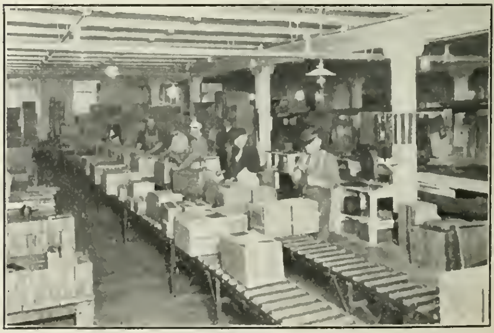


FIG. 10 MAKING-UP MISCELLANEOUS ASSORTMENTS OF GUM
Cases are filled at the right of the room and are sealed on the conveyors in the foreground.

Policies for Successful Operation

Work of the Industrial Executive

By B. A. FRANKLIN

Vice-President, Strathmore Paper Company

EVERY industrial unit must operate along lines of definite, constantly considered policies, or choose, generally unconsciously and hopefully, between drifting on the tide of circumstance and "happenstance," or with the operation of a quasi-shrewd opportunism. That there are very many industrial executives who take one of these latter courses is very evident from any reasonable investigation.

The advantage of having definite policies is, of course, very plain, because, back of every policy, if it is to be a worthwhile one, there must be serious consideration of tendencies, intent, desire, purpose, plan, and operation, and particularly of the success in the future, which a guidance of the circumstances the policies are to control will bring. No industrial executive is ready to admit that he can afford to have his industrial unit operated without such consideration. Policies are therefore natural elements of industrial success. No wise executive can afford to do otherwise than cover his whole field of operation with them.

But no wide-reaching scheme of policies can be laid down, unless, back of it, there is a reasonable understanding of industry, its significance and its tendencies.

> Many industrial establishments having no clearly formulated policies, drift, and as long as this drift is in the right general direction, the executive at the inactive helm is satisfied. Other establishments, with clean-cut and correct policies, go almost direct to the wished-for port. As explained by Mr. Franklin in the present article, the success of the first is largely chance—the success of the second is predetermined and almost inevitable. And the whole future successful development of industry "rests with the policies employed."

Industrial Beginnings

Industry is, by the very nature of its growth, a service. Far back in the beginning of the race, the caveman supplied his own wants completely. He got his living by foraging on what nature supplied. His policy was the simple one of go-out-and-get-it. This policy has never been entirely displaced, and in conjunction with other proper policies is still a successful one.

Gradually, as social necessities and obligations and the practical vision of humans, above that of animals, developed, the ideas of co-operation, specialization, and exchange were given birth and grew. Those who were hand-skilful made weapons and utensils; the hardy hunted; the experimenter found edible plants and grew them. These "producers" exchanged with each other individually or in groups, and each rendered his service in exchange for that of the other. Their life method demanded no more and permitted little more.

Index Number
658.31242 Industrial executive
658.1 Executive control

Gradually, as production developed, and there occurred an excess of it, this excess fell into the hands of those who were shrewd and powerful in government, and even this monopolization was justified on the basis or plea of service owed.

This plan of almost individual production went on for centuries. But all the while the standard of living was increasing, the idea of human rights was developing, the value of human co-operation was being made evident, and the understanding and control of natural elements and resources were growing.

The situation became too complex, with greatly increasing and wider-reaching demand, for individual production, and there sprang into existence, almost in the last century, the industrial unit, and the fundamental idea of our present-day industry. It has, of course, been greatly nurtured by the idea of profit-making, but its existence is still based upon, and absolutely dependent upon, two ideas.

The first of these ideas is that no industrial unit can long exist except on the basis of the value of the service it renders, because no one will buy, in the long run, that which he does not conceive to be of service. The fundamental and original principle of service exchange is essentially the same, even if removed by a medium of exchange from direct application.

The second idea is that the successful operation and the very establishment, indeed, of the industrial unit, depends upon the co-operation of a number of individuals each contributing his or her resources of capital or labor.

The industrial unit becomes, then, a center of service and co-operation. It does not properly exist for profit-making alone, essential as this is for its growth and prosperity. Its profit ought to be commensurate with its service. That this is the case, in the main, at least, is sometimes indisputably evidenced where a service is widely and uniquely worked out, as in the case of Henry Ford; but it would be found to be just as true in practically all successful cases when analysis is made, because, though idealistic, the principle is soundly fundamental in its extensive ramifications.

In addition there has developed in the last half-century, indeed almost in the last quarter-century, the idea that while industry is essentially co-operative internally, co-operation among industrial units in organizations externally is becoming more and more essential to success, because of increasing complexities of laws, of competition, of distribution, and of the development of management knowledge and methods.

The Future of Industry

When, then, the industrial executive gets this vision of the relation of his industrial unit and its progress to the whole of industry, and to those whom it serves, he will unquestionably find himself—if he is to operate to the maximum success and desires to meet his obligations of service—compelled to adopt definite and broad policies.

Undoubtedly the present-day tendency of industry is toward expansion, especially in America. Increasing invention and the control of natural forces, and increasing wealth, are raising the standard of living here beyond that of any other country. The increasing respect for human rights and the conservation and reproduction of natural resources are the limiting features of this expansion. If our natural resources are properly conserved and, in the matter of human rights, reward in proportion to service is understood and agreed upon, the fate of Greece and Rome need be no threat to our civilization.

External and Internal Policies

The policies of an industrial unit are both external and internal in their relationship and are, in many of their points of operation, evident enough.

The most evident external policy has to do with the public in the matter of markets, and the point of service arises here immediately, for the public offers in the long run no market to unserviceability. A study of the market, and of its constant and varying needs, has saved many losses and some complete failures. For instance, two concerns made an automobile accessory. In the development of the automobile this accessory became, in many cars, obsolete. One of the companies, not foreseeing this condition, failed and went out of business. The other, with a wiser executive and a definite policy of keeping in touch with the market, foresaw this obsolescence, developed other products, and went on to greater success. The latter executive had the broad idea of service to the public, and was sensitive to its wants and needs.

A manufacturer of a household article recently found his plant steadily losing money until a study of the market showed that the style and size of the article was rapidly changing. It took $50,000 of new machinery to meet the new conditions, but the plant immediately became a profit-maker after the change.

Then there are the questions of quality and price, of overproduction or underdistribution, both of the industry in general and of the particular unit. A most important point of consideration, also, in this connection, has to do with the method of distribution, whether through middlemen, owned agencies, retailers, direct users, or through some combination.

In each case there arises the question of price-fixing to the public or of resale prices, and of fair profit to agencies.

There must be settled also the question of publicity—of telling the world of the service.

All these questions are matters of the utmost importance, and demand the building and maintenance of a definite policy of study, observation, and education, if continuing success is to be obtained.

The Requirements of Competition

The existence of competition demands a fixed policy. In the older days the "cut-throat" policy of decrying and underbidding all competition whenever it became threatening was much in vogue. But public service does not demand any such policy, and it has latterly become evident that it is quite in the interest of the public and of the industrial units in any given line of production to unite in trade associations so long as these are kept within legal limits.

The public gains by trade associations of this character, as for example, in the work of the paint association and its appeal to "save the surface and save all." Such trade associations have before them the development of the industry for the general good, the development of cost systems, and the reduction of costs, the improvement of processes and machinery, the development of the market and the public understanding of the trade's products, the study of the market and its needs, the building of trade customs and codes of ethics to bring about equitable and ethical conditions.

Such associations bring about the reasonable and proper growth of industry, create wealth, and yet, when operated legally, as almost universally they are, are in the interest of the public generally and the trade particularly.

Every industrial executive, in the interest of his unit, should have a definite trade association policy, and the unit loses when he does not.

What the Industrial Association Has Accomplished

The advance of civilization with its concomitants of quick and widespread communication, of development and growth of new territories, of more detailed enactment of laws and their variation in different states, has brought about not only many complexities, but has developed many influences which, though indirect, are often very distinctly harmful to individual industrial units and especially to those in given localities.

These complexities and influences and the hardships they bring about, can be met and ameliorated, not by individual units which have neither the money, influence, nor time to devote to them, but by combinations, locally or nationally, of units into industrial associations, capable of studying them, and of taking united action towards their control. The industrial executive ought to study the requirements in this direction and the value of the industrial association as a means of meeting them, and have a definite policy for his unit in relation to associations of this nature.

The work of such associations as the Associated Industries of Massachusetts, the National Association of Manufacturers, and the Industrial Conference Board operates materially in many ways in the general interest, and deserves the consideration of every executive. The work of the Associated Industries in the matter of Power for New England may bear important fruit for the future of New England industries. There are records showing that in the matter of insurance and transportation some members of the Associated Industries have been saved as high as $25,000 yearly, since this combination of manufacturers is able to maintain bureaus which can thoroughly study all phases of such matters.

The associated fruit-growers of California have done splendid work for their territory—a work that could be done successfully in no other way. The public has gained and will still gain by it, but particularly the units operating together have profited and will continue to reap a mutual benefit.

The Importance of Outside Contacts

Then it must be thoroughly understood by the industrial executive that the art of management—the science, if you please—requires close contact with, and understanding of, the particular methods, processes, and operations peculiar to the trade. Beyond this, and of almost equal importance, he must keep in touch with the developments and discoveries of industrial engineering, and indeed with those of other engineering branches, which, in their principles, are applicable to all industrial units.

These developments and discoveries find their foci in engineering societies and their record in technical literature. They are of great economic value to the industrial executive and to his organization, not only from the point of view of a broadening vision and inspiration, but from that of actual cost reduction and plant improvement. This is so plain to many industrial executives it seems astonishing that it is not a matter of common knowledge and of common usefulness to all. The question of how best to obtain and keep in contact with this growing body of outside knowledge ought to be a matter of studied policy with every industrial executive, for any executive who studies even his own methods, will readily understand that they are not all of internal development, but were brought in from outside experience. There follows, then, as a matter of common sense, the policy of keeping them coming in.

Community Responsibilities

There is then the community in which the industrial unit operates, and his attitude toward this ought to be a matter of settled policy for every industrial executive.

The industrial unit owes a great deal to the community. It does not exist apart from it even when it creates it. It enjoys whatever privileges and suffers from whatever disadvantages the community offers. It is, indeed, an integral part of the community. It can readily help to improve its community by backing reasonably all movements for improvement, and, while apparently indirectly, will find an economic return in doing so. Or it can remain indifferent as too many do, and enjoy what others do, or suffer with what it has. If it wants its people happy and efficient, if it wants mechanically those things which will be of value to itself and them, and if it wants particularly to maintain a source of supply of workers of character and understanding, then the community and all movements looking toward the upbuilding of health, morals, education and character, ought to be of practical interest and policy to it, for, less than ever, can the interest of industrial units be confined within the fence or walls surrounding it.

The Industrial Organization

There are obviously many internal movements which must flow from set policies, where constructive growth and stable success are to be obtained, and indeed it is these matters which are of most interest and import to the industrial executive.

Probably the internal policy of first importance has to do with the executive organization. This is particularly so in industrial units making staple articles in open competition, not depending either on monopoly or exclusive processes. This will, of course, include the great majority of articles of production.

In the manufacture of such articles, made by known processes and highly competitive, the problem of success is ordinarily one of maintaining quality and cutting costs, and this involves certain definite elements of human ability. There must be a routine but constant planning, a careful preparation of materials and equipment, in order to create a steady flow of production through all operations without loss of labor and expense cost. Following this closely there should be a study of the running situation to check up the operation of the plan, to discover leaks, losses, wastes, delays, and departures from standards.

There is, in even the most staple manufacture, a constantly changing and improving scientific aspect. Machinery, tools, processes, methods, relations of operation are changing, requiring alert engineering ability.

Even in the most common materials, there exist chemical and physical relations, the knowledge and gaging of which make for quality and value, or the lack of which may, even without comprehension of the fact, be entailing obvious losses, or—less obvious—losses of profit that would otherwise have been made.

Assuming the main executive ability to be of the best, there is required, all down the line, a constant succession of minor executive abilities, each effectively dominant in its sphere of activity and influence.

Given the best manufacturing ability there must be capable exploitation and sales ability to keep the unit supplied with volume. There must also be abilities which will handle successfully the necessary financial problems that arise in all manufacturing operations.

Not merely to carry on, but to perpetuate, any industrial unit in successful operation, there is required a varying array of abilities which exist seldom in any one individual, but are best secured in a group of individuals of different trainings and temperaments. This group, consisting of principals and understudies, exists as the executive organization in all units, but undoubtedly best in those units where the selection, education, training and inspiration of these executives is a matter of thoughtful policy.

Labor Policies

Unquestionably the most important internal element in every industrial unit is labor, the control of which ought to be a matter of very thoughtful policies. That too many industrial executives have no very successful or definite policies in the matter of labor relations, is evidenced by the very considerable number of expensive labor disagreements; possibly also by the fact recently brought out by the Industrial Conference Board that 56 per cent of the labor of the country is operating under no reward plan, but on day work.

Day work is not essentially an unplanned method of labor operation, but unplanned labor operation is usually paid by the day, and it follows almost necessarily that neither will labor be satisfied to improve production, nor can plans be successfully or fairly put forward needing the maximum co-operation, without an adequate reward. The Ford plan, at first misunderstood as to its psychology, is, in effect, not a day work plan but a fixed reward for a compulsory fixed output.

The industrial executive wants to control the labor situation, but if he is to do so he must first have clearly in mind two fundamental ideas. The first is that in the last analysis the industrial unit is a center of service, and that those who contribute to its success have certain rights by virtue of their co-operation, even if they may in our industrial democracy quit or be discharged. From this idea may emanate a scheme of treatment which will avoid the loss of turnover and perhaps more serious labor troubles.

The second idea has been developing rapidly since the war let loose its flood of idealism, namely, a belief that a wage alone is not sufficient reward for labor. The conditions of employment and of living must be considered.

To these two ideas must be added the desire of the industrial executive to get the maximum efficient work hours continuously. Given all this and there is ample basis for the belief that only a broad and reasonable policy of the handling of labor and its relations can get the best results.

Equipment Policies

A third important matter of policy—the more important because of the latter-day development of invention and the mechanical arts—has to do with machinery and equipment. It is too often the fact, especially in our older manufacturing centers, that plants are operating with equipment that was the best in its day and is still in usable condition, which nevertheless, from the point of view of operation cost, as compared with more modern mechanism, is a drag on the profit possibilities of the plant.

A policy of keeping in touch with the advancement of machinery and equipment, together with some calculation and comparison of the possibilities of saving by replacement, would unquestionably advance many industrial units in the profit-making direction. The demand of the advancing day, if it is to be more work per labor hour, must be translated into more work per machine hour.

Every industrial executive must realize that in the advancing competition, that industrial unit is going to win best where there is a knowledge of the latest processes, the best use of materials and disposal of by-products and the finest quality, consonant with market prices, and where there is likewise some comprehension of the fact that science is making tremendous progress as well in its line as in all lines. Such an understanding and comprehension can only be intelligent if it brings about a study of these things through laboratories and research, as a definite policy to be followed by the systematic utilization of the information so obtained.

Operating Methods—Expansion

There is also the important question of growth and expansion. Every industrial executive expects his business to grow, in fact tries to make it grow. Yet how many thousands of plants there are where no idea in the layout of the plant and in its arrangement seems to exist, except for the immediate future and for temporary advantage. A further-sighted policy and vision, and a real belief in the latent hope for growth, would save not only much money in building, but even considerable in future operation. If there is one fact above all others which should influence the industrial executive it is this—that the best operation of any industrial unit is that which is based on the almost invariable truth that the profits of today are the result of the actions of the past, and the successes of the future are found in the actions of today.

A most important policy of the industrial executive has to do with his financial reserves. No industrial unit can provide all desirable facilities at the time they are decided upon. When there is immediate necessity or immediate return the executive may borrow the money. But many things can best be financed out of a reserve set up and annually increased. Hence to scatter profits in extravagant dividends is a policy which finally may cripple the business.

After all, it is well to remember that the great and important fundamental in the operation of any industrial unit is the fact that its own improvement, its strengthening, the general good of its own organization, and its service to the public, are all paramount to the profit desire, important as that is, of its stockholding interests. Operation on this basis will in the end bring the greatest financial returns.

Budgeting Advertising Expense

By J. L. PALMER

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MANY concerns which advertise do not have an advertising department within their organization, but place all advertising through a professional agency. Where an advertising department is set up to handle the advertising function its relation to the other departments, such as sales and production, varies widely. In some instances the advertising manager reports to the sales manager, thus tending to assure a close co-ordination between advertising and sales. In others the advertising department is quite distinct from the sales department, and co-ordination is effected through conferences.

Advertising Budget Summary Year *1925*

DIRECT EXPENSE														
Product	Actual Expense Last Year	Estimated *1925*												
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Total
A														
B														
C														
D														
E														
F														
Total														
INDIRECT EXPENSE														
Salaries														
Heat & Light														
Tel.&Tel.														
Repairs														
Other														
Total														

FIG. 1 ADVERTISING BUDGET SUMMARY

Advertising is usually a form of selling effort. Its purpose is to stimulate sales. That being the case, it should be so planned as to make possible the volume of sales which is best suited to the needs of all departments of a business. This is true whether the responsibility for advertising rests with an advertising manager or an advertising agency. Methods used will necessarily vary as a result of differences in organization and in problems.

There has been a great deal of discussion concerning methods of calculating the amount of the advertising appropriation. In most instances these discussions have not gone beyond the problem of determining the total appropriation. We are not directly concerned here with the question as to whether the appropriation should be based upon the unit of product, or anticipated sales, or past sales, or net profits. Our major concern is not only to find a method of estimating the total appropriation, but also a means by which we may anticipate the effect of the use of that appropriation upon the business as a whole. Detailed planning is obviously necessary to accomplish this second objective. A "lump-sum" appropriation is not adequate.

Index Number
659.1(C02) Advertising costs

The ideal advertising plan or budget would show:

1. The total cost of advertising during the coming year.
2. The cost of advertising each product or group of products.
3. The amount to be expended in each medium for each product or group of products.

A budget constructed in the above manner has numerous advantages over the familiar "lump-sum" appropriation:

1. It makes possible a comparison between the estimated costs of selling individual products or groups of products and the total anticipated income resulting from sales of these products.
2. It compels the laying out of a complete advertising plan in advance and therefore assures a more effective and better co-ordinated program than would otherwise be possible. It assures the directing of selling effort into the most profitable channels.
3. It results in a far better co-ordination between advertising and the activities of other departments than could otherwise be effected. Advertising plans are of direct or indirect interest to every major department of a business despite a tendency, often found, to view advertising as an isolated activity of a highly technical nature.
4. By setting up detailed expense standards, and enforcing those standards, a close control over advertising expense is assured.

With the above considerations in mind we may proceed to develop, by assuming a typical case, a possible method of planning and controlling advertising expenditures.[1]

It is assumed that the business under consideration has its own advertising department and does not assign its advertising to a professional agency. Its advertising is of three types: (1) Periodicals; (2) Mailing pieces; (3) Exhibits at conventions, fairs, etc. It is assumed that its products are six in number and that each product is advertised separately. The advertising organization consists of an advertising manager and his staff of clerks, copywriters, artists, etc. In this case we will have two classes of expenditure: (1) Direct costs, or expenses chargeable directly to individual products, such as a trade paper advertisement of product A; (2) Indirect costs, or expenses not chargeable directly to individual products, such as the salary of the advertising manager.

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[1] The procedure described is based upon the practice of a manufacturing firm, modifications being made to suit the requirements of this article.

The budget period is preferably a year in length and the advertising manager should begin work on the budget at least several weeks before the beginning of the period. Conferences with other executives will of course be necessary in order to ascertain the plans of other departments. After preliminary figures have been determined they are collected in summary on a report similar to that shown in Fig. 1. This report shows the estimated expenses by months, direct expenses being classified by products and indirect expenses by types. The actual expenses for the preceding year are shown for purposes of comparison. This form is usually suitable for submission to the budget committee, president, or board of directors.

It is not sufficient, however, to prepare only a summary estimate of the expenses of advertising each product. The budget summary should be supplemented by detailed estimates which account for each item of expense to be incurred in advertising each product. It is in this detailed planning that the budgeting of advertising expense finds its greatest justification.

Advertising Budget for *Product A* Year *1925*

	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.
Periodicals												
X												
Y												
Z												
Cuts												
Photographs												
Mailing pieces												
Booklet #18A3												
Folder #B21												
Circular#1826												
Folder #C10												
Exhibits												
A												
B												
Reserve												
Total												

FIG. 2 ESTIMATE OF ADVERTISING A SINGLE PRODUCT

One type of form useful in presenting a detailed estimate of the expenses to be incurred in advertising a single product is shown in Fig. 2. If a similar estimate is made for each product or group of products the effect will be to show not only the total anticipated costs of advertising each product or group of products, but also the detailed plans of the entire campaign. The advertising manager has a picture of the activities of the year before the year has begun, and a scientific analysis of the probable effect of the program can therefore be made. It will be noted that a reserve is set aside for each product. This may or may not be feasible, but is usually advisable because of the difficulty of preparing absolutely accurate estimates. Needless to say, the amount of the reserve should be small as compared with the specific appropriations.

After the advertising estimate has been approved it is the responsibility of the advertising manager to see that it is not exceeded. A system of records and reports is needed whereby comparisons may be made promptly and at frequent intervals between actual and estimated expenditures. The regular accounts of a business will rarely give a sufficiently detailed classification of expenditures to provide adequate control. For this reason it is usually desirable to provide in some manner for a supplementary tabulation of all charges to advertising expense. This may be handled by a clerk in the accounting department, or perhaps by a clerk in the advertising department if no objection is held to decentralized records. Postings are made by this clerk to a record which provides a classification of expenditures conforming to the classifications in the detailed estimates. At the end of each month totals are taken and reports submitted to the proper executives.

Advertising Budget Report Year *1925*

Product	Estimated for the Year	January		February		March	
		Estimated	Actual	Estimated	Actual	Estimated	Actual
A							
B							
C							
D							
E							
F							

FIG. 3 ADVERTISING BUDGET REPORT CARD

The original estimates, when approved, are transferred to cards similar to that shown in Fig. 3. These cards are then filed by the advertising manager for his reference. As actual figures become available they are posted to the cards.

The original plan must be held subject to change in the event of unforeseen developments of a serious nature. The advertising budget should be flexible, and the mechanism for making changes in the appropriation during the budget period should be set up before the system is installed. Changes should be permitted only upon the approval of a responsible agency.

The cost of budgeting is often raised as an objection to the installation of a system of budget control. One case which is quite typical may be cited in reply to this objection. In this case the cost of operating the advertising budget is approximately one-third of one per cent of the total advertising appropriation.

The description of budget procedure above presented is not, of course, of universal application. A classification of expenses by products will not always be possible. A classification by territories may in certain cases be feasible. It is believed, however, that the principles herein developed may be widely applied.

Paper and Pulp Manufacturing

Job Standardization, Wage Incentives and Bonus Plans of General Applications

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THE paper industry has such a diversity of classes and subdivisions that it is impossible to treat the management factors in any general way. The methods of management vary with the nature of the raw material and the extent to which fabrication of the product is carried. The manufacture of wood pulp and paper is only the beginning in an industry which produces an infinite number of forms of finished product.

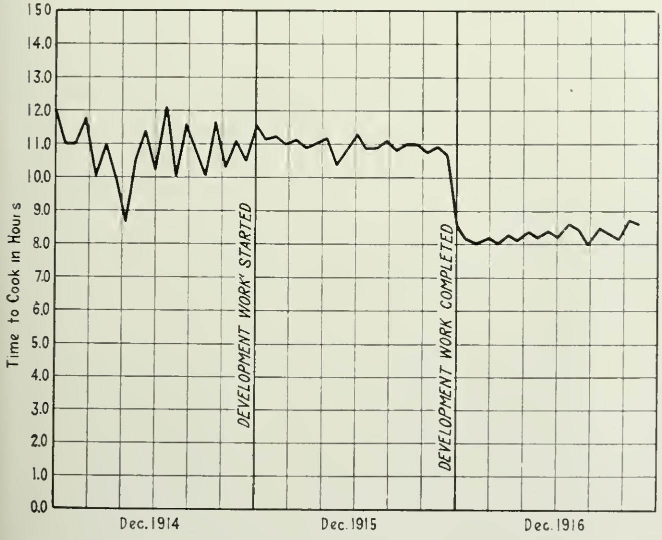

FIG. 1 ANALYSIS OF COOKING WOOD PULP SHOWING TIME FOR 20 CONSECUTIVE COOKS IN THREE PERIODS

In its broad characteristics the industry may be separated, so far as production is concerned, into two divisions: First, the processes, largely continuous, in the manufacture of pulp and paper; and second, the supplementary processes performed sometimes in the finishing-room of the paper mills, but often in independent plants. These two divisions are distinguished not simply by the character of the processes but by the two different types of production methods that are adapted to them. In raw material manufacturing, the process features of standardization and methods of treatment of the raw and semi-raw materials predominate; in the supplementary processes, the fine questions involve the handling and distribution of the materials and the problems of labor incentives. Fundamentals in both divisions comprise research, analysis, control of production, and the development of production standards.

Index Number
658.9:676 Management in the paper industry

Because of diversity in materials and processes certain fundamental principles can best be illustrated by examples of actual proceedings in a few plants. While the methods indicated may not be adaptable in detail to other cases they will serve as illustrations and suggestions.

The operations in a sulphite pulp mill offer a good example of the economies to be gained from standardization of the processes and the effect of incentives in maintaining the standards.

In order to picture the features entering into the problem, a brief description of the process is necessary. Logs are barked, knots removed, and the pieces run through a chipper. The steel digesters are filled with the chips which are then covered with bisulphite-of-lime liquor. The cooking proceeds for a period of from 8 to 14 hr., after which the pulp is blown off into large tanks. It is washed, screened, bleached, and run either into wet sheets or rolls, or pumped to the paper mill.

The following example is drawn from work done in a large eastern plant.[1] As the process is continuous, the attack is centered on a scientific investigation: (1) to determine the proper materials and methods to produce the desired results; and (2) then to put them into effect as standards.

The incentives in the pulp mill are paid for meeting the standard requirements and are usually independent of questions of output, although output increases when incentive is earned. Each operation was studied and incentive fixed to satisfy the requirements of individual responsibility.

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[1] See "Development of Scientific Methods of Management in a Manufacturing Plant," by Thompson, Lichtner, Hall, and Guild. Transactions A. S. M. E. Vol. 39, 1917.

The incentives of the men who transfer the sticks to the wood room are based on uniformity of supply as recorded by a clock, and in getting in the required quantity of wood on time. The bonuses of the men who inspect the logs on the carriers and throw out the poor ones are reduced by the number of poor logs which they leave for the chipper men to throw out. To balance this, the chipper men are paid a bonus for the poor sticks they throw out. Inspection of the work regulates the quality. In some of the work, such as that of the floor men and the men at the chip screens, a regular bonus is paid, provided the inspector, who makes his rounds at intervals, reports satisfactory work done.

A bonus is paid for keeping the strength of free acid within certain limits for specified temperatures, another bonus for maintaining the required strength of SO_2 gas as shown by an automatic recorder, and a third for firing the sulphur furnaces within two minutes of the specified time. A bonus is paid for keeping the strength of slaked lime to the specified Baumé tests and maintaining uniformity in the temperature of the lime water.

Pressure gages and recording thermometers show the temperature in the digester at all times. Standard curves were established for temperature and pressure. The temperature chart is examined by an inspector to determine how much it varies from the standard chart. Beginning two-and-a-half hours after the cooking is started, the deviation from standard is noted by inspection at intervals. If the curve is maintained within 3 deg. of the standard limits, the cook is paid a bonus of 3 cents an hr.; if within 4 deg. of the standard, he is paid 2 cents an hr.; if within 5 deg., 1 cent an hr.; while if it runs more than this he receives no bonus on this division of his work.

A second bonus is paid for getting the pressure up to the required point at the designated time, and a third bonus is paid for blowing off the batch at the proper color. The cooking liquor grows darker as the cooking proceeds, and the exact time to blow off is governed by the color of the liquor, which can be drawn off through a cock. If the sample of liquor taken at the time of blow-off is of the proper color, the cook receives a certain reward; if the next color to it, a smaller reward; if of the third color, a still smaller reward. The total of the three rewards constitutes his total bonus for the day.

Under the old methods the time of cooking varied by 50 per cent. Fig. 1 shows that standardization brought down this range to 10 per cent. Further study reduced the average time of cooking by one-third and permitted a 45 per cent increase in production. The time reduction, in connection with standardization and elimination of poor cooking, not only increased the output but lowered the quantity of raw materials as shown in Fig. 2.

Various incentives were established in the wet room. Density, that is, a uniform percentage of water mixed with the pulp, is important in several operations. A bonus was paid for maintaining a certain density within defined limits in bleaching. The result of this incentive is shown in Fig. 3. Other features included maintenance of required temperatures and more exact standardizing of the color. Incentives on the dry machine were set for percentage of moisture, and thickness of sheet. The net result of this work of standardization was not only an increase in quality and uniformity, but also an increase in production, the mill actually turning out 45 per cent more pulp without increasing the number of digesters.

Standardization and Planning in Paper Mill

It is not possible to describe all the activities in installing scientific methods and control in a typical plant, but two or three major problems are worth describing.[2]

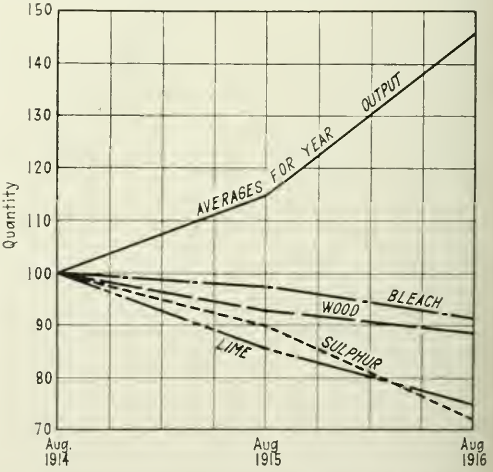

FIG. 2 RATIOS SHOWING DECREASE IN MATERIAL AND INCREASE IN OUTPUT FROM 1914 TO 1916

The chief aims in routing the materials and planning the running of the different kinds of paper are to produce uniformity of product, to reduce number of "furnishes," to get the paper out on time, and to avoid changes on the machines by grouping orders. The method of attaining these ends varies with the product, volume of production, and local characteristics. It is well to remember that in production control the same plans can seldom be adopted even in two similar plants. Each development must be designed for the particular case.

The planning department performs the following functions:

1. It receives all orders from the sales department and acknowledges them the day they are received with a promise date of shipment.
2. It determines the sequence in which jobs are to be run.

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[2] See "Development of Scientific Methods of Management in a Manufacturing Plant," by Thompson, Lichtner, Hall, and Guild. Transactions A. S. M. E. Vol. 39, 1917.

3. It keeps each machine and work place supplied with work.
4. It directs and controls the moving of materials and orders.
5. It transfers operators from one job to another so that every worker always has some defined task to perform.

In planning the making of the paper the production man of the making department accumulates incoming orders for the same grade until he has enough ready for a run, when he puts them through on a "furnish" order and fixes the dates on which each will be run. From this order of work the production man prepares a schedule or running list for each of the paper machines. From these running lists the stores issues for materials to be used can be made. The advantages of such planning over the older method are many, but some of the more obvious are: it provides absolute control of the sequence in which orders shall be run; it decides when the work is to be done; an extension of this plan, if desired, gives the production men precise information as to the exact status of any order in the mill at any time.

Beating is important as a preparatory process to the production of uniform paper. The variables which have to be considered and studied in the making of paper are as follows:

1. Control of amount of bone-dry stock put into beaters.
2. Control of density of stock, that is, the percentage of water which is to be mixed with the pulp.
3. Development of proper method of beating for maximum strength, this being dependent upon set of beater roll at start and the varying of beater roll during the process of beating.
4. Development of proper methods for testing:
    (a) Density.
    (b) Fiber length.
    (c) Fiber strength.
    (d) Slowness.
    (e) Set of beater roll.
    (f) Velocity of stock in beater.
    (g) Strength of each of the raw materials.
5. Determination of relation between proper method of beating and proper method of jordaning and running on paper machine.

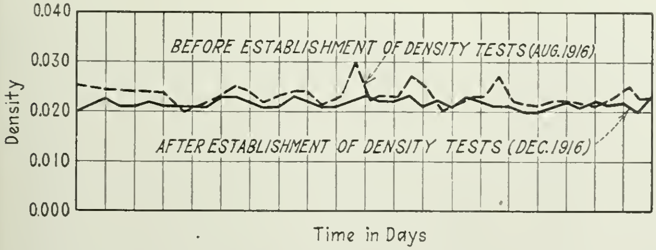

FIG. 3 UNIFORMITY IN DENSITY OF PULP THROUGH INCENTIVE PLAN

In the study of these variables one of the great difficulties was found to be to get each of the ingredients going into the beater to contain the same amount of bone-dry stock per unit of volume. To determine the percentage of moisture special centrifugal apparatus and a well-defined system of taking records had to be developed. It is possible now to know what is actually going into each "furnish," and its fixed definite time of beating. In somewhat similar fashion the sizing has been further standardized with marked saving in cost of material.

There are three ways in which the output of paper from the machines is being increased: (1) by increasing the speed of the machine; (2) by widening the sheet on the paper machine, or, as it is technically known, increasing the deckle width; and (3) by reducing the number and length of shutdowns through better planning of the orders.

In the case under observation past records were tabulated and showed that the speed of the paper machine for each kind of paper varied at different times by large percentages. Through the partial standardization of beating which had been accomplished, and as the result of the study of machine speeds, definite speeds for certain grades of paper were established and maintained. In Fig. 4 are shown the curves for one kind of paper for different grades. It was found possible to increase the speed as much as 30 per cent and sometimes more over the average of old speeds. An incentive was arranged for the machine tender and his assistant, according to the saving which they made on the various factors. In Fig. 5 is shown an actual record of the variation from the limits specified and the method by which bonuses were computed.

The production man of the finishing department controls the orders after the paper is run off the paper machine. From the production man of the making department he obtains the date on which the paper for each order will be run and determines his own schedules. Promises for the various orders are sent to the sales department and each order is entered in the car-promise book, which is kept in the planning department, and is one of the most important features of the plan in its effect upon the delivery of the order. On the day the order is received it is assigned its place in the running list and (on paper) loaded in the car in which it will be shipped, possibly weeks or months later.

A typical example of the standardization in the finishing department is that of the operation of trimming paper. All paper after it has been finished is trimmed to an even size by making cuts, with a trimming knife, on all four edges. It is apparent that one great factor in the economies of this operation is the amount of paper that can be trimmed with one cut of the knife. Scientific study was made of just how much paper could be cut at once without damaging the stock. The proper sequence in which the different edges should be trimmed in order to expend the minimum of time and effort was determined. The amount of paper a man could lift from the truck to the trimming table and from the trimming table back to another truck without strain or undue fatigue, or danger of cracking the surface of the stock, was also determined. The curve indicating the amount of paper per lift is shown in Fig. 6. An incentive to do a piece of work as prescribed on his instructions and to do it in the time allotted to him, in this particular case took the form of a bonus of 35 per cent. Of course, the establishment of incentive work has been accompanied by a close and rigid inspection and a bonus is not allowed unless the work passes inspection.

Filling Orders Promptly

Further investigations were made to determine the amount of stock which should be carried in order to fill orders promptly and not tie up too much capital in stock. The results were a large reduction in the amount invested in stock, standardization of the quantities of each item to be carried, and an arrangement of the stock house that permitted quick and easy location of any item desired.

Work materials balance sheets were made for all items. All issues and material received tickets pass through the hands of the balance-of-stores clerk who keeps these records and makes the proper entries. When the quantity of stock available falls to the amount indicated as a minimum, the balance-of-stores clerk issues an order for the amount of paper to be made. No order for stock can originate from any other source. When sales increase or decrease, this fact is recorded and affords a means to keep the minimums and amounts-to-order clearly adjusted. Some results of this study are: the maximum stock carried was reduced nearly one-half; the stock house which had been considered too small was found to be ample; the number of men required to handle the stock was reduced from nine to five, who, in addition to their regular work, assisted in the packing of shipments.

An interesting example of simplification is that which has been accomplished by the American Writing Paper Company, as described by its former president, George A. Galliver.[3] As he describes the situation, the company had 26 mills, 55 paper machines, an average of 40 specifications of paper per machine, and was carrying 2000 varieties of paper. It conducted an intensive investigation of possible simplification and as a result retained about 10 per cent of the former numbers of bond paper, 4 per cent of fine papers and linens, 14 per cent of ledgers and 12½ per cent of cover papers.

Sales and manufacturing schedules were planned together and adjusted to meet the needs of both so that the final schedule was a composite of sales and manufacturing experience. Orders were assigned to give each kind of work to the mill which could do it best, and one result of this was that each mill got increased production and lower costs from continuous runs.

In another article[4] Mr. Galliver schedules the following 12 advantages which have accrued from the simplification of their paper output.

1. Reduced equipment.
2. Small investments in raw materials, materials in process, and finished products.
3. Easier financing.
4. Fewer shutdowns.
5. Less idle equipment.
6. Less idle labor.
7. More permanent employment.
8. Less difficulty in getting help.
9. Standardized material inventory.
10. Cheaper handling of stock and fewer broken packages.
11. Less experimental loss.
12. Better service to customer.

An interesting activity of a large paper manufacturing company is the forecasting of 25 items which have to do with major policies and master control and which furnish the basis for definite master plans and schedules.[5] These items are sales in dollars and pounds of paper, pounds of paper to be made, trends of raw material prices, current assets and current liabilities, and cash receipts and disbursements. The forecasts are made for four months ahead and a new forecast drawn up at the end of each month, so that planning for immediate current operations and planning for future operations are in process of continuous correction throughout each year.

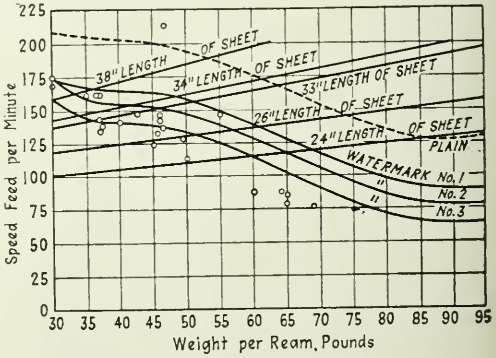

FIG. 4 SPEEDS OF PAPER MACHINE FOR A CERTAIN GRADE

Planning the Manufacture of Paper Products

The following description of the planning system in a paper products plant is from data secured by knowledge of the system itself and from an article prepared by a member of the planning department.[6] The planning department of this company is of the central type; with the dispatching de-centralized by departments or groups of departments. This centralized planning makes it possible to collate small orders so that economical runs can be made and so that the planning of materials or special preparations can be advanced to avoid continuous "rush" methods. The system is devised particularly to take care of made-to-order goods, although the planning of goods made up for stock is well taken care of by the same system. The plan is working with great satisfaction in this particular plant. For any other business, even of similar nature, while the general principles apply, the details would need to be worked out in a different manner.

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[3] "How We Applied Simplification," *System*, September 1921.

[4] "Twelve Savings We Have Made," *Factory*, October 1921.

[5] "How We Plan Four Months Ahead," by J. W. Seoville, *Factory*, July 1921.

[6] "Production Planning at the Dennison Plant," *Factory*, February 1922.

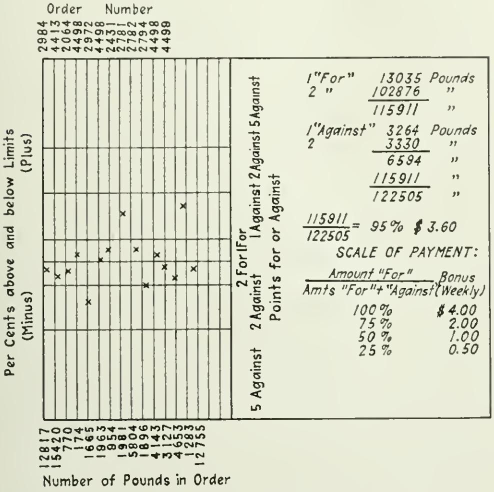

FIG. 5 WEIGHT INCENTIVES ON PAPER MACHINE

The seven points which are outlined in the article regarding the planning operation and what it involves, are well worth restating.

1. We must know what is wanted, and when.
2. We must know what the article consists of, where parts come from, what is to be done with them, what facilities can perform work, waste allowance, and speed of machines.
3. Orders must be written for each operation, and for all materials and tools.
4. We must have means of identifying and locating each part.
5. We must have a means of tracing the progress of the work quickly, accurately, and constantly.
6. We must have summaries of the work to be performed at each production center.
7. The central planning department knows which orders are most important, or in other words, the relative importance of all work to be performed.

The planning department has a schedule clerk for each manufacturing division and one or more local dispatching clerks located within the principal manufacturing departments to dispatch the work as it is laid out for them. The sales order is recorded, numbered, censored from a manufacturing standpoint, approved for credit, and, if a printed job, marked whether or not electrotypes are available. From the sales order factory work orders are transcribed which in their finished form comprise a series of colored sheets, one each of a distinctive color for each department through which the order must pass, and bearing the numbers of these departments in the order in which the work is to be performed. Special instructions and a general description of the job appear. The last, or master sheet copy, remains with the central planning department for record purposes.

The departmental routine is placed in the proper squares on the master sheet. The time required to execute the job is marked on all producing department orders, also the job classifications and the standard waste allowance, all of which is recorded in code. Various other kinds of information peculiar to the business also appear on these manufacturing orders.

At the same time index strips are written for the schedule clerk. These show date of order, factory number, customer's name, code description of the item, actual running time and due-out date. These index strips are filed by the schedule clerk in tube style index frames, and transparent colored markers are employed to convey special information. All machines and other facilities are listed on these frames and every job already in the factory is listed ahead of some machine or facility in the principle producing departments. When he has determined the assignment to any given machine or facility, the schedule clerk dates the order for the preliminary service departments using the due-date several days earlier than the time when the principal operation is to be started. Then the various sheets go to the schedule clerks representing the departments doing the work subsequent to the principal operation, who establish the due-date for the work they control with reference to the work already ahead of the facilities that are located in their particular departments.

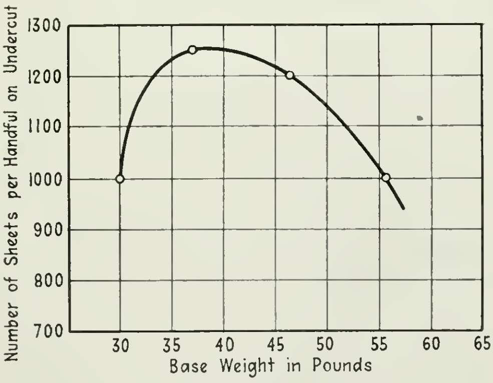

FIG. 6 NUMBER OF SHEETS PER LIFT FOR TRIMMER

After a job is completely scheduled the manufacturing order sheets are separated, and each planning clerk in the central planning department files the orders for their particular department under either "available" or "not available" files, the term "available" being used to show those in which all the preliminary work and materials are in such condition that immediate assignment can be made. These files are further subdivided to show the condition of work for each machine or facility.

When goods are delivered by a preliminary service department their sheet goes with the goods as a move ticket to the department designated, where the material is given a location which is recorded on the order sheet. The order sheet goes to the central planning department, where progress is recorded on the master sheet. Departmental dispatching stations do not receive orders from the central planning department until they are actually needed by the departments as shown by central planning schedules. The particular facility needed has already been determined, but the routine of the dispatching station takes care of the assignment and reservation of tools; control of the movement of materials to facilities including any preparatory work in connection with them; keeping the work ahead of all facilities so that there is no lost time; keeping payroll and cost records of all labor; and directing removal of finished work and any residue materials.

The local dispatching clerk makes out work tickets in duplicate for each operation, one copy for the operator and the other for pay-roll and cost accounting purposes. The operator's ticket is thin paper while the office copy is a regular machine tabulating card as used in modern machine tabulating work. The dispatching station is connected with the factory workrooms by means of pneumatic tubes, so that work tickets are thus sent to a central place in the various workrooms from which the operator takes them and to which he returns them when the job is completed. The dispatching clerk uses a pocket style control board for assignment of work to the various facilities. A considerable amount of checking of preliminary operations and the availability of tools, dies, etc., is required before the work ticket can be moved to the pocket on the control board which shows that the job is ready to be worked on. The use of the tabulating machine work ticket leads to many economies of operation, and permits the securing of varied types of information which are of great value to the company and particularly to its control and cost records.

Time Study and Rate Setting

Job analysis and time study for the development of methods and rate setting are highly advanced at the Dennison plant and standard conditions and standard times are considered as basic essentials for production control and for the development of the co-operation and contentment of labor. Under no condition is an attempt made to set any wage rates until all of the working conditions have been standardized in so far as possible.

Most businesses find it difficult to bring about a close co-ordination of the plans and operation of sales and production. The Dennison Manufacturing Company has attempted to solve this problem by setting up a merchandising division as a major function to bring about better co-ordination and to act as a balance between the factory and the sales department. This division is responsible for the determination of the product, for the scheduling of amounts to be sold and produced, and for the prices and terms of sale. Monthly schedules are made up and the merchandising division has been able to bring about almost continuous production and employment in the business by reason of its special knowledge of the problems and needs of both production and sales. A master plan must be ready by June 1, for the succeeding calendar year, and must be approved by the merchandising committee and the heads of important departments. Month by month scheduling covers three months at a time.

There are five merchandising committees functioning under a main committee with an impartial chairman. Each merchandising committee operates a section covering a major line of product. The merchandising manager, who is chairman of the sectional committee, his assistant, selected for his analytical qualities, and four other men from the sales and production departments constitute the committee.

Results of Standardization

The direct results in money saving that follow developments based on thoroughly scientific analysis in the paper industry are surprising. In paper coating, by routing and scheduling of work, improvements in equipment and the application of a method of payment whereby the operative is given, in addition to the flat rate, a money incentive for increased production combined with reduction in waste, the results have been that production has been increased 80 per cent, wages increased 61 per cent (of which a part has been a basic wage increase), production cost decreased 41 per cent and paper waste reduced 74 per cent. These results were accomplished in a plant excellently managed and making large profit even before these developments were completed.

In a plant manufacturing folding paper boxes, by routing and scheduling of work, standardization of equipment, and a task and bonus method of payment based on time study in place of piece rates set by foremen, the wages have been increased from 50 to 100 per cent, production increased 50 per cent, and the cost decreased 25 per cent.

In the work of a finishing department of a plant making paper advertising specialties (mostly handwork), by routing and scheduling, standardization of methods, and the application of task and bonus payment, the wages have been increased from 50 to 100 per cent, the production from 10 to 150 per cent, and the cost slightly lowered. In this case the work was done during a period of rising basic wages.

One of the features that is often neglected even in well-planned development is the maintenance of, or improvement in, quality. By making the quality requirement an essential feature in earning a bonus and at the same time working out definite quality standards it has been possible to carry on such operations as inspecting and sorting paper, reeling, coating, and other work requiring skill in such a way as not only to increase production sometimes as much as 100 per cent, but also to maintain uniform quality and particularly to develop the interest and initiative of the workers.

Southern Transportation Facilities

The Piedmont Section of the Carolinas

By RALPH G. MACY

Consulting Mechanical and Electrical Engineer

TRANSPORTATION facilities of the Piedmont section[1] constitute one of the factors that have contributed materially to the remarkable industrial development that has taken place in this section of the South within the last few years. The railroads are rendering excellent service and the large sum that is being spent for highway work in these states is producing a road system that will be unequaled in the southern section of the United States.

The Piedmont section, as can be seen from Fig. 1, stretches across the states of North and South Carolina, approximately two-thirds of its area being in the former state, and one-third in the latter. The building of highways is largely a state function, and a brief description of the general activities of these states in road construction should be of interest, as a good system of highways in a section of this kind plays an important part in the industrial development of the community.

South Carolina has not as yet embarked upon the elaborate program that is being undertaken by North Carolina, but it has done some excellent work in improving its roads. It has not so large a percentage of hard surface roads as North Carolina, which can be seen from Fig. 1, but it is doing excellent work in maintaining the existing highways. Table 1 shows the various types of highways that are in the part of the state that lies in the Piedmont section, with the approximate mileage of each type.

Many of the roads are top-soil finish sand, or gravel, and the people of the state do not appear to be prepared yet to make the expenditure necessary to build the permanent hard surface roads that are being constructed in North Carolina. South Carolina in the 11 counties which are in the Piedmont section, expended over $530,000, including the federal aid funds, on highway work in 1923.

Previous to 1921, the road situation in North Carolina was inadequate for a state that was growing so rapidly. With the building of new factories and mills in the Piedmont section a demand was created for inter-city transportation facilities that could not be met properly by the roads in their condition at the time. The realization of the necessity of first-class roads took hold of the people, and after considerable debate, the General Assembly of North Carolina, in 1921, voted $50,000,000 for road work. Two years later the General Assembly voted $15,000,000 more, and with $11,000,000 available from federal aid, the state had at its disposal $76,000,000 for highway construction and maintenance. This large sum was exclusive of some $100,000,000 that was spent by the counties on roads during this period.

Index Number
625.7(75) Roads in the South
656.2(75) Railroads in the South

The State Highway Commission, which had charge of construction and the expenditure of this money, consisted of 9 members, of which Frank Page was Chairman, and this Commission has earned the respect and regard of the people of the state. Under its jurisdiction was placed the maintenance of some 6100 miles of highways which, in the opinion of the people, was a wise arrangement. The Commission secured some 3682 miles of roads of which 1448 miles were paved and 2234 miles had various other types of surface, and also the connecting bridges. Some idea of the magnitude of the work can be obtained when it is noted that this Commission will purchase some 80,880 carloads of crushed stone, some 44,774 carloads of sand, and over 21,700 carloads of cement. Up to January of this year the amount of road work under contract and construction in the state totaled some $39,277,000. This included 1952 miles of roads—1022 miles being paved at a cost of $29,925,000 and the remainder being graded and surfaced at an approximate cost of $8,352,000. There is also being spent over $1,000,000 on bridge work. On the same date there had been completed approximately 884 miles of paved roads and some 1327 miles of roads of top-soil, gravel, and other types of surfacing.

TABLE 1. MILES OF ROADS IN THE PIEDMONT SECTION, SOUTH CAROLINA—DECEMBER, 1923

Miles of Roads in Piedmont Section	Hard Surface	Earth or Gravel Surface	Imp. Provided For	No. Imp. Provided For
1060	37	922	28	137

TABLE 2. MILES OF ROADS IN THE PIEDMONT SECTION, NORTH CAROLINA, COMPLETED BY JANUARY, 1924

Total Miles	Plain and Reinforced Concrete	Asphalt Concrete	Macadam	Top-soil, Clay, and Gravel Graded
2211	391	350	143	1327

In Table 2 is given the mileage of the various types of roads.

That the building of roads by the state has been a profitable investment in many ways is evident. The following shows the immediate returns accruing to the citizens of the state and is but one of the many direct

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[1] Preceding articles have appeared in MANAGEMENT AND ADMINISTRATION for May 1924, p. 517; June 1924, p. 663; July 1924, p. 47; August 1924, p. 167; September 1924, p. 253.

TABLE 3. MILES OF ROADS COMPLETED IN 1923

PLAIN CONCRETE	GRADED	RECONSTRUCTED	COST
18.97	49.59	31.80	$6,800,000

TABLE 4. MILES OF ROADS UNDER CONSTRUCTION

PLAIN CONCRETE	REINFORCED CONCRETE	ASPHALT CONCRETE	MACADAM BITUMINOUS	TOP SOIL	GRADED	COST
120	43.78	101	21.51	157.67	44.98	$2,900,000

benefits received. In 1920 the registration showed there were 142,284 automobiles in North Carolina, and there was shipped into the state 73,997,832 gallons of gasoline, which meant an average consumption of 520 gallons per car. At 25 cents per gallon this equaled an expenditure of $130 per car for gasoline. In 1923 the registration had increased to 247,000 cars or an increase of 73 per cent in the year. There was consumed 110,332,300 gallons, or an average of 446 gallons per car, which meant a saving of 74 gallons which at 25 cents equaled $18.50 per car. With a registration of some 247,000 cars the saving to the car owners was $4,619,500, which was more than the amount required to pay the interest and sinking fund on the bond issue of $65,000,000.

In the Piedmont section the road situation is now excellent and Fig. 1 shows the number of miles of hard-surfaced roads and the number of miles of roads that have top-soil, sand, or gravel finish. The top-soil roads are maintained in excellent condition, and while they are not, of course, the equal of a hard-surfaced road they are extremely comfortable to ride on in passenger cars.

TABLE 5. NUMBER OF MILES OF TRACKAGE OF MAIN RAILROADS AND NAMES OF ASSOCIATE COMPANIES OF THE SOUTHERN RAILROAD SYSTEMS

Southern Railway, double track	263 Miles
Southern Railway, single track	603 Miles
Southern Railway, miles of road	866 Miles
Southern Railway Associated Companies Atlantic and Yadkin Railway	120 Miles
High Point, Randleman, Ashboro and Southern Railroad	28 Miles
Yadkin Railroad	41 Miles
Carolina and Northwestern Railway	80 Miles
Total miles of road Southern Railway and Associated Companies	1,135 Miles
Carolina, Clinchfield and Ohio Railway	30 Miles
Norfolk and Western Railway	18 Miles
Piedmont and Northern Railway (Electric)	113 Miles
Seaboard Air Line	180 Miles
Charleston and Western Carolina Railroad Company	130 Miles

Table 3 gives the approximate number of miles of each type of road completed in 1923 in the Piedmont section and shows the activity in this area of the state where the greatest industrial growth has taken place.

Table 4 gives the number of miles of road under construction in this area and the approximate cost.

This figure shows a considerable expenditure for a relatively small portion of the state, but the manufacturing activity certainly warrants it.

Between the various cities of this section such as Greenville, Charlotte, Winston-Salem, and Greensboro there is a constant stream of traffic. The motor busses tie all the larger cities of this section together, many trips being over 100 miles long. The busses are modern and certainly render fast service. Many of the roads pass through exceptionally attractive country, and it is possible to obtain a better view of the Piedmont section from these cars than by any other means of transportation. The road system of the state has made it famous among car owners of the South and East.

The railroads running through the Piedmont section have had to handle an exceptionally large volume of freight and passenger traffic due to the rapidly increasing industrial activity in a relatively short period. Fig. 2 shows the various railroads and the predominating position occupied by the Southern Railroad System and its associated companies. There are six railroads in this section, the Columbia, Clinchfield and Ohio, the Norfolk Southern, the Charleston and Western Carolina Railway Company, the Piedmont and Northern Railway, the Seaboard Air Line, and the Southern Railway System. The last-mentioned railroad owns the majority of stock in the companies running between Salisbury and Norwood, Badin, High Point and Ashboro, and from Walnut Cove through Greensboro to Sanford. In South Carolina it owns the majority of the stock in the line running from Belton to Walhalla. Table 5 gives the number of miles of trackage of the main railroads of the Piedmont section and also the names of the associate companies of the Southern Railroad Systems.

TABLE 6. CLASSIFICATION OF INDUSTRIES ON SOUTHERN RAILWAY SYSTEM MAIN LINE—NORTH CAROLINA STATE LINE TO AND INCLUDING EASLEY, S. C.

TEXTILE INDUSTRY:	
Cotton mills	178
Cotton mills under construction	2
Braider mills	1
Bleaching, dyeing and finishing plants	8
Bleaching, dyeing and finishing plants under construction	2
Mattress, batt and felt mills	4
Miscellaneous cotton mills	1
Woolen and worsted mills	1
Woolen and worsted mills under construction	1
Jute mills	3
Silk mills	1
Knitting mills	27
Saw, planing, shingle, stave and heading, sash door and blind, and miscellaneous mills	14
Hub, spoke, and handle factories; box, barrel, keg, and crate factories; Miscellaneous woodworking factories	27
Cotton seed oil mills, cotton gins, and cotton compresses	12
Furniture factories	61
Coffin and casket factories	2
Flour and grist mills	32
Brick, tile, sewer pipe, pottery, cement, and concrete works	12
Shoe, trunk, leather goods and harness factories and tanneries	4
Abattoirs, slaughter and packing-houses	7
Steel and iron works, foundries, car works, iron, brass and copper ornamental works, stove factories, blast furnaces	24
Miscellaneous industries	115
Total	539

The main line of the Southern Railway System, which is double tracked, runs through the industrial center of the Piedmont section. At Greenville and Spartanburg it touches the great textile mills with their large freight shipments. In North Carolina it runs through Charlotte, Gastonia, and Salisbury where it handles the textile shipments and the freight from the miscellaneous factories that are being built in this section. At High Point and Winston-Salem and at Greensboro and Durham it obtains through its associate companies the freight from the knitting mills, the

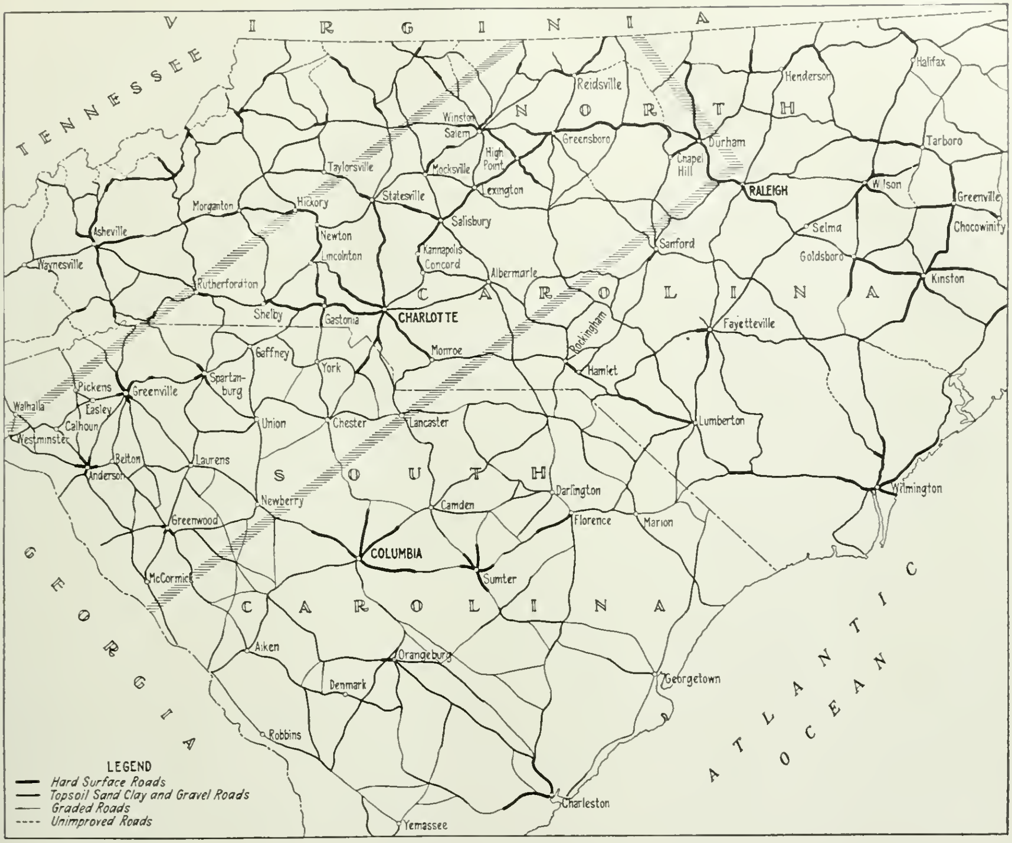
VIRGINIA
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ATLANTIC OCEAN
Reidsville
Henderson
Halifax
Winston Salem
Greensboro
Durham
Chapel Hill
High Point
Tarboro
Taylorsville
Mocksville
Lexington
RALEIGH
Wilson
Greenville
Chocowinity
Morganton
Hickory
Statesville
Salisbury
Selma
Goldsboro
Asheville
Newton
Lincolnton
Kannapolis
Concord
Sanford
Kinston
Waynesville
Rutherfordton
Albermarle
Shelby
Gastonia
CHARLOTTE
Rockingham
Fayetteville
Gaffney
Monroe
Hamlet
York
Spartanburg
Pickens
Greenville
Walhalla
Easley
Calhoun
Westminster
Union
Chester
Lancaster
Lumberton
Belton
Anderson
Laurens
Newberry
Darlington
Wilmington
Camden
Greenwood
Florence
Marion
COLUMBIA
McCormick
Sumter
Aiken
Orangeburg
Georgetown
Denmark
Robbins
Charleston
Yemassee
LEGEND
Hard Surface Roads
Topsoil Sand Clay and Gravel Roads
Graded Roads
Unimproved Roads

FIG. 1 MAP SHOWING HIGHWAYS OF THE PIEDMONT SECTION

furniture factories, and the huge tobacco plants. In Table 6 is given a list of factories that are located on the main line of the Southern Railroad System between the northern boundary of North Carolina and Easley, South Carolina, and which is exclusive of the factories that are located on the lines of its associated companies, such as the factories that are situated at Winston-Salem and Durham, towns not on the main line. This table shows the diversity of manufacturing that is being carried on in the Piedmont section. Some idea of the extent of this freight business can be obtained when it is noted that the Reynolds Tobacco Company requires 12,000 freight cars per year for shipping its products to distribution centers.

The general freight movement of the main products of this section is found to be as follows: Of the tobacco products, some two-thirds move West and one-third North; of the textiles, approximately one-third moves West and two-thirds North. The Southern Railway System runs a textile special daily that leaves Greenville, South Carolina, and goes to Salisbury, North Carolina, and the Spencer yards, where the goods for the West are placed in separate cars for shipment. The remainder go to the Potomac yards across the river from Washington, from which point they are shipped North. There is also a tobacco special that leaves Winston-Salem at 9 P. M. which connects with the textile special at Salisbury. Here the freight is distributed—the smaller portions going North and the larger portions West.

One indication of the industrial growth of the Piedmont section is the increase in the freight return from the larger cities of this territory, and in Table 7 the returns are given for Charlotte, High Point, and Winston-Salem in North Carolina, and Greenville in South Carolina. These cities are representative of the main industries of this section.

In the vicinity of Charlotte, which is located approximately in the center of the Piedmont section and is in rapidly developing territory, there are many diversified manufacturing plants and also a large number of textile mills. At High Point there is a great furniture center and its product is sent throughout the United States. Winston-Salem, while shipping a quantity of furniture and knit-goods, is mainly a tobacco manufacturing city. This city, which claims

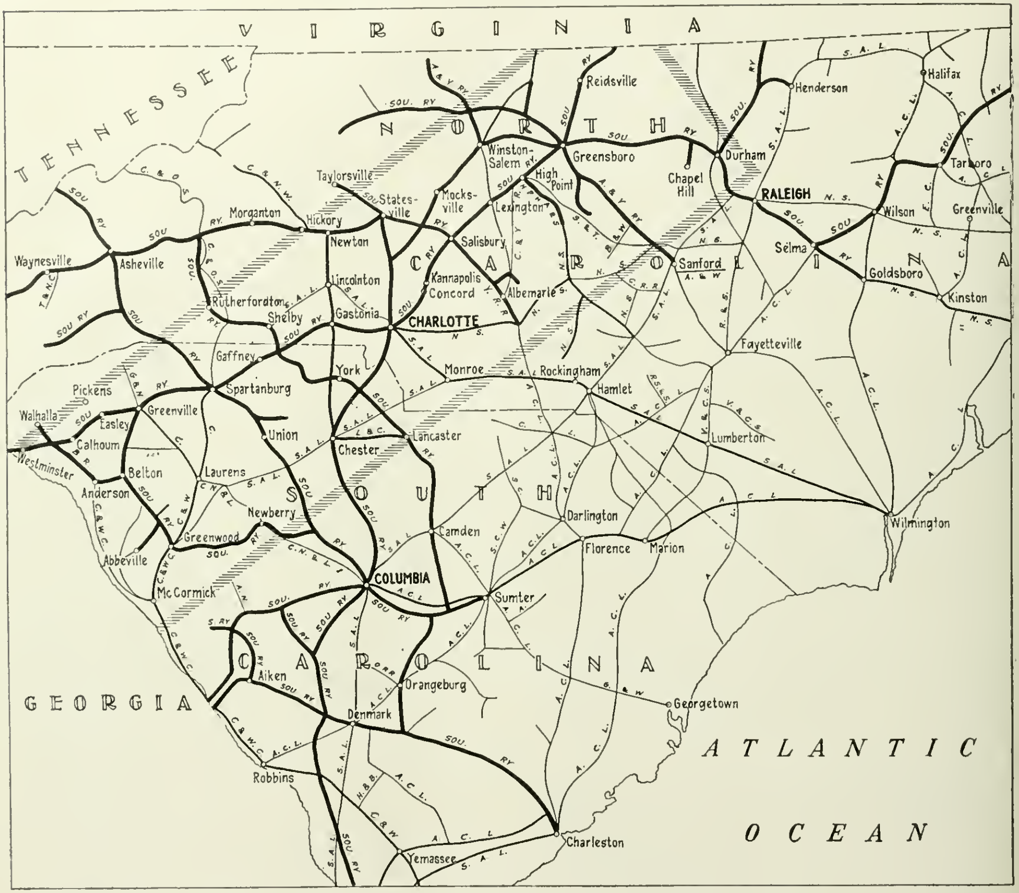
VIRGINIA
TENNESSEE
NORTH CAROLINA
SOUTH CAROLINA
GEORGIA
ATLANTIC OCEAN
Reidsville
Henderson
Halifax
Winston-Salem
Greensboro
High Point
Durham
Chapel Hill
RALEIGH
Tarboro
Taylorsville
Statesville
Mocksville
Lexington
Morganton
Hickory
Newton
Salisbury
Wilson
Greenville
Waynesville
Asheville
Selma
Sanford
Goldsboro
Kinston
Lincolnton
Kannapolis
Concord
Albemarle
Rutherfordton
Shelby
Gastonia
CHARLOTTE
Fayetteville
Gaffney
York
Monroe
Rockingham
Hamlet
Pickens
Spartanburg
Greenville
Walhalla
Easley
Calhoum
Union
Chester
Lancaster
Lumberton
Westminster
Belton
Anderson
Laurens
Newberry
Darlington
Greenwood
Abbeville
Camden
Florence
Marion
Wilmington
COLUMBIA
McCormick
Sumter
Aiken
Orangeburg
Denmark
Georgetown
Robbins
Charleston
Yemassee
SOU. RY
S. A. L.
A. C. L.
N. S.
C. & W. C.
C. N. & L.

FIG. 2 MAP SHOWING RAILROAD FACILITIES OF THE PIEDMONT SECTION

a population of some 60,000 people, showed a freight forwarding revenue of $2,506,131. It is the only city of the four mentioned where the forwarding freight revenue exceeded the received freight revenue. This is due to the shipments of tobacco from the large manufacturing plants in this city. It should be remembered that a considerable quantity of the tobacco leaf used in the production of cigarettes and other tobacco products is brought into the town in wagons and automobiles by the tobacco farmers. Greenville,, South Carolina, is largely a textile city and it is here that the gray goods and sheetings are manufactured. In this vicinity there are a number of the large finishing plants to which the goods are shipped from various parts of the Piedmont section to be bleached and finished.

The passenger service on the main line of the Southern Railway System where it runs through this section is excellent, as many of the fast trains stop at the cities of Charlotte, Greenville, and others that are located on the main line. The local service is not exceptionally good, as the automobile busses which run on a more frequent schedule between the various cities carry a large number of local passengers and therefore it does not appear to be good policy for the railroad to operate a large number of local trains. In fact, they appear to have cut their local trains to a considerable extent. However, with the double-tracked main line of the Southern Railway System running through the center of this section, and with its branch lines and its associated companies running through the territories on both sides of the main line (Fig. 2), and with other railroads operating in this area, there are excellent railway facilities to meet the demands of the section.

As this is the last article of this series a brief resumé of the main factors that have played an important part in the development of this section will be given. These factors are climate and location, nearness to the supply of raw materials and to the markets, power supply, labor situation, and the transportation facilities discussed in this article.

The location of the Piedmont section is a particularly advantageous one, and is responsible for its splendid climate. Situated on a rolling plateau at the base of the Blue Ridge Mountains on the eastern side of the range, it is protected from the cold winds of the North and West. It varies in elevation from 450 ft. to 1000 ft., and the cool nights in this vicinity undoubtedly play an important part in the vitality of the people.

The rapid industrial growth of the section is shown in Table 8, which gives the increasing value of the textiles, tobacco products, and furniture manufactured in this territory. The table also shows the relative importance of the various industries.

The section is also well located with reference to the large cotton-growing areas of the South, and is in the center of a tobacco-growing territory. The timber for a large part of its furniture and lumber industry comes from the immediate vicinity—the slopes of the Blue Ridge Mountains—and so it is certainly near to the supply of the raw materials which are used by its three main industries.

There are many other industries, such as the manufacture of fertilizer for the extensive agricultural activities of North and South Carolina, the manufacture of cotton seed oil products and the manufacture of boxes, etc., for which the raw materials are at hand in this section. For the marketing of its products it is well situated and can readily ship them to various parts of the southern section of the United States. It can also supply the central and eastern sections and it is only 750 miles from the great metropolitan district.

Extensive manufacturing activities such as those of the Piedmont section require a large amount of power. The largest individual industry, manufacturing of textiles, requires a considerable proportion of the total power consumed in this territory. The remarkable development that has taken place in textile machinery during the past decade has made this industry largely a mechanical one and has materially increased the power demand. At a rough average of 1 kw. of demand for 32 spindles the electrical generating capacity required by this industry in the Piedmont section—should all of the spindles be operated at one time—would be some 325,000 kva. With regard to the power supply the section is exceptionally fortunate in having cheap power due to the hydroelectric developments on its rivers. On one river, the Catawba, which rises in the Blue Ridge Mountains and flows in a southeasterly direction through this territory, there has been constructed 9 hydroelectric generating stations by the Southern Power Company with a combined generating capacity of 353,800 kva. There is also the Broad River on which this company has constructed a plant of 22,500 kva. capacity and numerous other small water plants which generate power from the streams which rise in the adjoining Blue Ridge Mountains.

TABLE 7. STATEMENT OF APPROXIMATE FREIGHT REVENUE ON TRAFFIC FORWARDED FROM AND RECEIVED AT THE CITIES GIVEN BELOW

CITY	1923		1916		INCREASE IN PER CENT FORWARDED	INCREASE IN PER CENT RECEIVED
	FORWARDED	RECEIVED	FORWARDED	RECEIVED		
Charlotte, N. C.	$972,972	$2,001,357	$496 676	$802,403	95	149
High Point, N. C. ...	599,507	1,038,054	200,772	300,694	198	145
Winston-Salem, N. C. ..	2,566,131	2,125,791	985,276	758,363	160	180
Greenville, S. C.	382,026	1,240,416	201,191	541,086	89	129

TABLE 8.—VALUE OF PRODUCTS IN PRINCIPAL INDUSTRIES OF THE PIEDMONT STATION

INDUSTRY	VALUE OF PRODUCT		PERCENTAGE OF INCREASE	INCREASE IN VALUE OF PRODUCTS IN U. S. IN PER CENT	PERCENTAGE MANUFACTURED IN PIEDMONT SECTION
TEXTILES:	1912	1922		1914-1921	
South Carolina—Cotton Goods.	$69,475,000	$229,670,691			
North Carolina—Knitted Goods	52,868,68	180,218,000	240	150	80
Total	128,424,04	437,241,045			
	1912	1922			
North Carolina: Tobacco	35,932,000	214,830,000	497	114	98
	1910	1922			
Furniture	11,232,000	30,288,761	170	100	80
	1912	1922			
Miscellaneous Factories....	86,030,562	149,368,476	74	...	44
TOTAL VALUE OF MANUFACTURED PRODUCTS:	1914	1921			
North Carolina	289,412	665,118,000			
South Carolina	138,819	236,421,000			
Total	428,331	901,539,000	110	80	..
AGRICULTURE:	1910	1922		1910-1922	
North Carolina	131,072,000	382,700,000			
South Carolina	137,379,000	204,700,000			
Total	268,451,000	589,400,000	119	44	..

The Southern Power Company also has four steam plants with a capacity of 92,500 kva. which are connected to this system thus assuring a constant power supply to the industries of the section. This company has some 2830 miles of transmission line which transmits current throughout the territory. It is interconnected at four points with six other companies which, with the Southern Power Company, form the great superpower system of the southeastern part of the United States. There are also several other small companies in this territory. The opportunity afforded the manufacturer to purchase power in most cases cheaper than he can produce it allows an appreciable amount of capital which would otherwise be tied up in power plant apparatus to be expended in installing machinery to increase production. Cheaper power has undoubtedly played a part in the industrial development of this section.

With regard to the labor situation, which is a matter of great importance to the manufacturer of today, this section of the Carolinas is in an exceptionally advantageous position. The manufacturer has two sources of labor to draw upon. One is the farming population—for this section originally was agricultural—which is mostly of English stock that has lived in this section for many generations. They have a strong local pride, are thrifty, and have a desirable viewpoint with regard to property rights.

In the Blue Ridge Mountains adjoining this section live the hill people, the other source of labor supply. They are of pure English stock and have also lived in these mountains for generations, but their living conditions in most cases are exceedingly primitive and the percentage of illiteracy is somewhat high. However, they have capacity, a highly developed racial and local pride, and many other desirable qualities.

The majority of mills and factories in the Piedmont section build their own mill villages for their employees. The houses are constructed of wood, shingled, and contain from four to six rooms. In many cases they have running water and electric lights, and in many of the villages the streets and sidewalks are paved and lighted. The mills maintain community houses which are centers of social activity, and medical attention is given to the employees free of charge.

When the hill people and certain of the farming element were offered these living conditions there was no difficulty in obtaining labor at a moderate wage. When it is noted that over 95 per cent of these people are American born of American parentage it will be realized why the union agitator has not made much headway with this laboring population who consider people from another state as "foreigners." The Piedmont section is certainly sufficiently well equipped with labor to become a great manufacturing center.

It is hardly necessary to state that the business men of the Piedmont section are of the highest caliber and the industrial growth testifies to their exceptional business ability.

With its excellent climate and location, its nearness to the source of raw materials and markets, its extensive water-power resources, its exceptional labor situation and its people, the Piedmont section of the Carolinas has had a remarkable manufacturing growth. If this continues, it will some day be the industrial center of the southern part of the United States.

Electric Steam Generator to Save 3000 Tons of Coal

COAL savings estimated at 3000 tons per year are expected to result from the installation of an electric steam generator recently ordered by the St. Croix Paper Company. Improved power factor and utilization of spring and fall high water are looked forward to from other electrical machinery just put in.

The hydroelectric plant of this company is on the St. Croix River 12 miles from the company's mill. A 3360 kw., 2400 volt, vertical waterwheel generator is now under construction to be used as a spare unit and to permit the utilization of high water in the spring and fall for the generation of excess power. This excess power may be used either for the making of wood pulp or for running the electric steam-generator. Wood pulp made in this manner during the flood season will be stored away as dry pulp laps and will be made into paper during the dry summer and fall months.

Engineers estimate that the new generator may produce as high as 15,000,000 kw.-hr. excess power at high water periods, with a normal rainfall. By putting this power into the electric steam generator, they expect a saving of approximately 3000 tons of coal a year. The steam-generator is to be located in the boiler house and will be piped into the main steam line, supplementing the coal-fired boilers. Steam necessary to heat the mills on Sundays and holidays, when the motor load is shut off, will come from the electric steam-generator and the load curve of the mill will be ironed out by having the steam-generator take up the variations in electrical load on the mill from time to time. The present electrical machinery and that now being installed was made by the General Electric Company.

Index Number
621.1816 Electric steam generators

Three definite results are expected by the St. Croix officials: power factor correction by the synchronous grinder motor; the utilization of otherwise waste energy by working up raw material in advance of requirements; and the substitution of electrically generated steam for part of the steam ordinarily produced by coal.

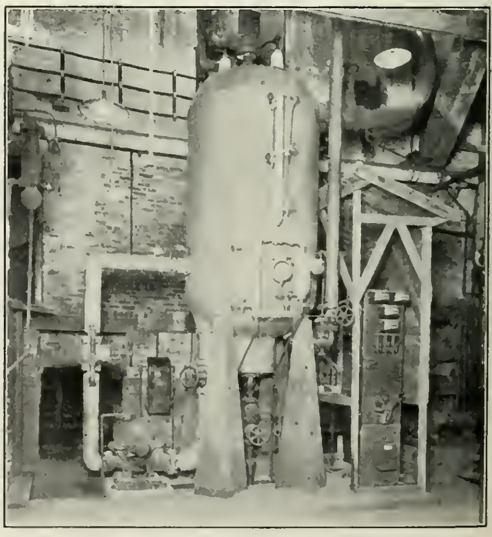

FIG. 1 ELECTRIC STEAM GENERATOR

Tests for Shop and Office Jobs

General Electric Company's Experience at West Lynn Works

By B. P. CAMPBELL

General Electric Company

NINETY per cent of the men and women who pass through the employment offices of large industrial concerns have no definite preferences as to the type of work which they undertake. They are merely in search of a job—and are perfectly willing to try their hand at any work, so long as the pay proves satisfactory."

This is the statement of an employment expert at the West Lynn works of the General Electric Company. It may explain, to some extent, the fact that so many persons become dissatisfied with their work and drift from one job to another causing the labor turnover which has long been the despair of employers.

The Why of Labor Turnover

Some time ago an engineer turned practical psychologist at the General Electric Company's West Lynn plant. He devoted months to an attempt to discover the "why" of labor turnover. Today he says:

> Employers are attempting to fit square pegs into round holes. There is some line of work for which every man and woman is especially fitted. Placed at such work they will reach their highest efficiency, will be much more satisfied than they would be working at tasks for which they have no aptitude, and so will be less likely to be continually moving on.

Attacking the problem from this basis, this man, Johnson O'Connor, by name, began looking for a way to remedy the existing situation—for a method by which he could ascertain the type of work at which applicants for employment should be placed. His problem was made easier than it might otherwise have been, because he had the whole-hearted support of F. P. Cox, manager of the West Lynn works. It was made more difficult because it was believed that, just as industry has made a place for the physical misfits, those unfortunates who face the battle of life with physical deficiencies, so a place should be made for the mental misfits. In other words, this engineer-psychologist was attempting not only to place workers of normal intelligence in the line of work for which they were best suited, but was also trying to devise a means by which persons of sub-normal intelligence could be placed at work which would make them self-supporting and of positive benefit to mankind.

Best Type of Work for Given Individuals

The question, then, was—How can we discover, quickly and accurately, what type of work given individuals should be doing? The answer came in the form of a second question—Can we devise "sample jobs," tests which will indicate along what line any person applying for work has the most ability?

Index Number
658.311563 Trade tests

Those in the West Lynn works who are most interested in the problem to which Mr. O'Connor is devoting his time, believe that such a course of procedure is possible. They feel certain that a start in the right direction has been made, but they also feel that it will be years before the problem is completely mastered.

This much, however, is certain; 50 sample jobs have been made up, and 45 of them have been scrapped, because they did not work. The tests are always tried before they are used to test applicants for work. No sample job is considered practical until it is ascertained that experts in a given line can pass it readily. Even then a test is not used until it has been found that those who pass a test satisfactorily before entering a line of work find themselves adapted to the work; and that those who fail to pass it satisfactorily find later that they are not adapted to the task. Unless a "sample job" meets these requirements it is discarded, and some of the tests which were expected to be extremely successful have been thrown out.

Five Tests Used in Hiring

Five tests are now being used in hiring men and women at the West Lynn works—used because they are apparently accomplishing their aim. At the present time no one is hired there without first taking these tests, and, in general, employment is given on the basis of the tests.

Before an applicant for work is tested it is made clear to him that the object of the test is not to bar him from employment, but to aid him in securing the most congenial work possible. The applicant further understands that everyone fails in some of the tests, but that some one of them is practically certain to indicate an aptitude for some line of work. Every precaution is taken to eliminate nervousness on the part of those being tested.

Should an applicant feel that he is especially adapted for some line of work, he is given a "sample job" devised to indicate whether or not such is the case. If he passes the test satisfactorily he is recommended for employment of that sort. If he fails, he is given other tests. At the present time there are in use sample jobs in clerical work; fine instrument assembly; engineering, drafting, and design; inspection; and an executive test which Mr. O'Connor frankly admits may need considerable revision to make it work satisfactorily.

The clerical test consists simply of a sheet of paper on which are two parallel lists of numbers arranged in groups of five each. In the first group each number consists of two digits, such as 87, 96, etc. In the second group the numbers consist of three and four digits, and so on, until in the last group they consist of ten and eleven digits each.

Method of Checking for Accuracy

Also parallel to these columns of numbers are two columns of dotted lines, one headed "Same" and the other "Different". The person being tested places a check in the column headed "Same" if the numbers are alike, and in the other column if they are different. Thus the numbers and checks for one group might be:

		Same	Different
963787	963788	. . . .	. . X . .
517843	517843	. . X .	. . . . .
1758214	1758214	. . X .	. . . . .
7785261	7785621	. . . .	. . X . .
5320629	5320629	. . X .	. . . . .

The time required to complete this test is taken on a stop-watch, and the score is figured on the basis of time and accuracy.

Although the test may appear absurdly simple, some of the results which have been attained are truly surprising. Especially so is a check which was made on the test. Forty-three girls were tested. They were graded with the following results: 13 received an "A" grade, the highest mark given; 10 received a "B" grade, eleven a "C" grade, and nine a "D". The results of the tests were kept secret, not even the girls knowing what they received. This was done so that the subsequent check would be unaffected by the original grades. These girls all voluntarily entered a comptometer course then being given. This course cost them $5 each, and no one was forced to drop it, no matter how poorly she might do.

Teacher's Gradings Compared With Original Grades

At the end of the course, which ran three months, the teacher's gradings were compared with the original grades given after the "sample job" test. It was found that 8 of the girls who received an "A" had done "Very good" work in the course. Four had done "Good work," and one did "Fair work". Eight of the girls receiving a "D" had become discouraged and dropped the course of their own accord, while the ninth had done "Fair work". Three girls receiving a "B" did "Very good work" in the course, five did "Good work," one did "Fair work," and one did "Poor work". Of those receiving a "C" grade, one did "Very good work," four did "Good work," five did "Fair work," and one did "Poor work". It becomes immediately apparent that those who showed remarkable facility in the test stood very well at the end of the course, while those who did poorly in the test became discouraged before they finished the course.

Those who are most enthusiastic about the future of this method of employing applicants for work say that at the present time they have gone no further than to be able to pick the very best and the very worst in a given line of work through "sample jobs". The time will come, they believe, when it will be possible to devise such tests which will tell exactly how well adapted a person is for certain kinds of work, but that, they admit, is far in the future.

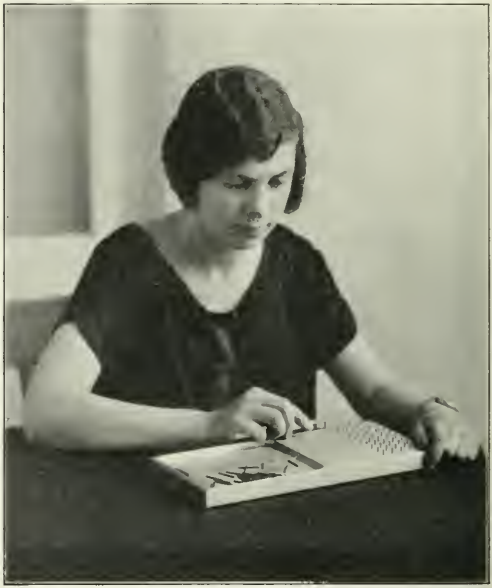

FIG. 1 MANUAL DEXTERITY TEST FOR INSTRUMENT ASSEMBLY

The test for fine instrument assembly consists of a square board containing 100 holes into each of which three brass pegs fit loosely. These pegs are placed on a table and a girl being tested picks them up, three at a time, using one hand only, and inserts them in the holes. (See Fig. 1). Fine instrument assembly demands great manual dexterity. Previous to the time that this test was devised, only about one out of every ten girls hired for this work found it agreeable. They could not attain any speed at their task, and found their wages low. As a result nine out of ten girls moved on in a short time. Thus the company was spending large sums of money training girls who brought them practically no return in production.

Sample Job Used for Hiring Girls

This "sample job" was used for hiring girls only after it had been carefully checked—as is the case with all tests. It was found that successful instrument assemblers could pass it easily. It was also found that girls who passed the test became successful instrument assemblers, and that those who failed in it found it impossible to succeed as instrument assemblers. Simple as it seems, this "job" has proved a reliable indication of a girl's manual dexterity. Today only girls who pass the test are hired for work of this type at West Lynn, and the turnover among these workers has been materially reduced.

Has a man an engineering or designing bent? A block of wood, sawed into 9 irregularly shaped pieces, is used to answer the question. When fitted together the pieces form a rectangular cube. When first shown to the prospective engineer, designer, or draftsman, this is assembled. He is shown that it consists of 9 pieces, there being 3 pieces in each layer, horizontally and vertically. The pieces composing the block are then mixed up, and the applicant is asked to reassemble them. (See Fig. 2.)

Two Factors Enter into Decisions

Two factors enter into the decisions based on this test. One is, naturally, the time element. The other is the manner in which the applicant attacks the problem. The man with a natural inclination for designing or engineering begins assembling the pieces with a definite plan in mind. He works with the evident intention of forming a rectangular cube. The man who has no such inclination merely attempts to make the irregularly shaped pieces fit together, regardless of what the result may be. The blocks have been assembled in less than a minute by a man who never attempted the task before, but this is exceptionally fast time. Other people have worked for 15 minutes, and more, without success.

It is interesting to note that when two graduates of one of the country's leading technical schools applied for engineering positions at the West Lynn works, one of them passed the test in excellent time, while the other was completely baffled with it. It was recommended that the man who failed be put at some other work, but this recommendation was not accepted, since both men had done excellent work while in college. Both men went under one department head. In three months the man who failed had to be dropped, while the other man was doing excellent work.

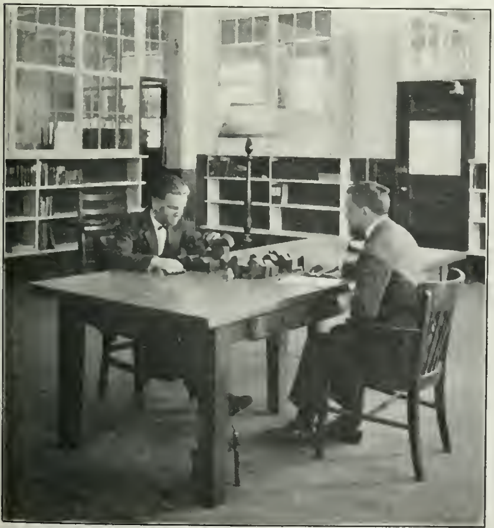
FIG. 2 MR. O'CONNOR CONDUCTING THE ENGINEERING TEST

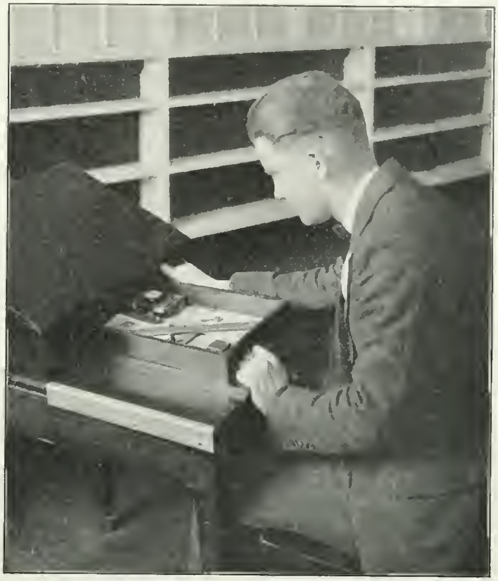
FIG. 3 OBSERVATION TEST FOR INSPECTORS

Again, the head of a designing department sent a number of his employees to take this test. Only two of them passed it satisfactorily, which puzzled Mr. O'Connor, who gave the test, since this had apparently been a most successful guide. It developed that these two men were the only ones among all those sent by the department head who were actually doing designing work, the rest being in clerical positions of one type or another.

Inspection of small work requires, in the main, rapid and careful observation. The inspection test consists of a drawer containing such articles as a ruler, a pad of paper, a penholder, a watch, an eraser, etc. (See Fig. 3). The applicant is allowed to look at this drawer for one minute. It is then drawn under a hood and an article is either added to or taken from those already in it. The drawer is then shown to the applicant once again, and he is asked to tell what change has been made. Merely a test of observation, yet an indication as to whether or not one is likely to make a good inspector. It has proved successful in picking inspectors for small work.

Not only have the tests been given to those applying for work at West Lynn, but an opportunity to take the tests has been given all present employees. Many employees have availed themselves of this opportunity, which has resulted in some of them being shifted, with good results, to work of a type for which they were better suited than the job which they had previously.

As has been pointed out, those who know most about this system of hiring by "sample jobs" are the first to insist that their work is but in its infancy. They hold no belief that they have discovered a universal panacea for the ills of the industrial world. But they do believe that as time goes on they will be able to do more and more to make workers more satisfied with their lot, to find the place in industry which they feel certain exists for people of sub-normal intelligence, and to reduce very materially labor turnover.

And the work is always going on with these aims in mind. The tests now in use are being improved. New tests are being devised and tested, accepted or discarded, as they either work or fail. The scope of the work will be broadened when successful sample jobs of additional types of work are devised.

Care and judgment are of paramount importance in the use of tests such as these. They have been worked out scientifically and must be administered scientifically. They are not rule-of-thumb guides to be used arbitrarily. Existing conditions should be studied in any plant where sample jobs are to be used in the employment work and the tests should be made to fit these conditions rather than to attempt to make the conditions fit the tests.

Maintaining Accuracy in Railroad Track Scales

Index Number
625.18 Track scales

ACCURACY in measurements of time has long been a well-known factor in railroad operation. Another place where accuracy is nearly as important, but which has not received as much publicity as time measurements, is in railroad weighing devices. In order to compile accurate statistics of the volume of freight movements as well as to fix freight charges on certain shipments of bulk materials it is necessary to weigh loaded and unloaded cars.

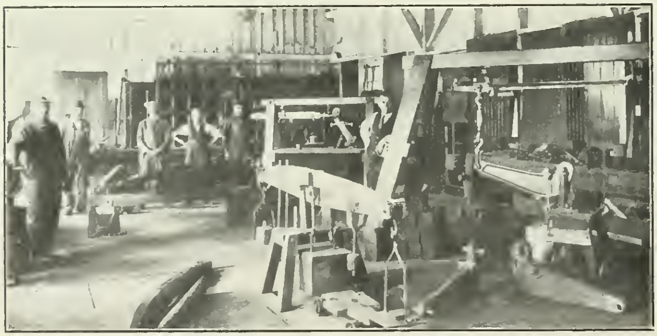

FIG. 1 INTERIOR OF REPAIR SHOP

The Southern Pacific Railroad maintains a general scale shop at West Oakland, California, where all scales belonging to the railroad are constructed, repaired, and regulated. (See Fig. 1). In addition to their own scales, this shop has charge of scales belonging to the Pacific System, the Arizona Eastern lines, the Pacific Electric lines, the Northwestern Pacific Railroad, and the Southern Pacific lines in Mexico.

All small, portable scales and dormant freight house scales built at the West Oakland Shops are set aside when completed for inspection by the State Department of Weights and Measures. The scales must be accurate to one ounce when 100 lb. is placed on the platform. Scales that meet these rigid requirements are sealed by the state official and are then forwarded to their various destinations.

The Southern Pacific uses test cars which are kept exactly to a known weight, usually 40,000 lb. (See Fig. 2). On a master track scale located at West Oakland, state officials weigh these test cars several times a year. If necessary their weights are adjusted until they are exactly 40,000 lb. each. When each car has been brought to the proper weight it is closed up tightly and all locks are sealed by the state sealer. These cars are then sent out over the system, accompanied by state officials, to test the various track scales. For scales of 100- or 150-ton capacity a variation of only one point in a thousand or one-tenth of one per cent is permissible. When the variation exceeds this amount the scale is adjusted before it is sealed by the state inspectors.

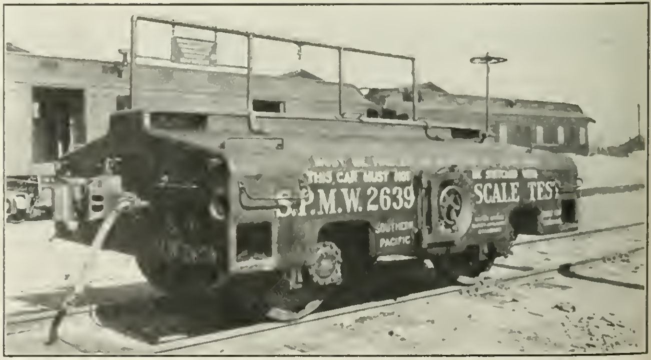

FIG. 2 SCALE TEST CAR

Convention of the N. A. C. A.

Review of the Fifth Annual Conference, September 22-25, 1924

By HENRY W. MAYNARD

Member of the Association; Assistant Treasurer, The Salt's Textile Mfg. Co.

THE annual convention of the National Association of Cost Accountants marks another definite stride in the progress which the Association has made in its five years of existence. This article is not the story of the convention, but a resumé of its "high points". At the request of MANAGEMENT AND ADMINISTRATION, the writer has endeavored to summarize, first, the *new ideas* which were developed, and second, the *trend of thought* along cost accounting lines. To do this has not been an easy task. With the wealth of material in prepared papers and rapid fire discussions, the choice of important points must be largely a matter of personal opinion.

Arrangement of the Sessions

The convention consisted essentially of six technical sessions, each covering a definite subject and directed by a chairman, who chose three principal speakers to present prepared papers bearing on some feature of the special subject. Vigorous discussions followed each group of prepared papers, each speaker being limited to three minutes. Since the subjects are treated chronologically in this review, some reference is made to individual papers. However, many papers cannot be mentioned, for lack of space.[1]

The Opening Gun

On Tuesday, September 23, the convention opened. Colonel B. A. Franklin,[2] Vice-President of the Strathmore Paper Company, departed from the traditional terms of an address of welcome to lay emphasis on cost accounting as a *business fundamental*. Speaking both from his earlier professional experience and his activities as a practical manufacturer before and since the war, he stressed the fact that the cost accountant is responsible for giving to the financial heads of a business the information necessary to enable them properly to establish their policies and fully to control the operations of the business.

President J. P. Jordan, who followed, agreed so strongly with Colonel Franklin that he changed from his anticipated subject matter to lay more emphasis on the same subject. Mr. Jordan stated that cost accounting at the present time is on trial more than ever in the past. The current business depression has laid economic pressure upon industry to reduce expenses to the utmost, and executives and financial heads are focusing the microscope upon cost and accounting departments, which can justify their existence only by providing proper information in the most useful way. Executives have been blamed by cost men, Mr. Jordan said, for failure to use the figures prepared, but instead the fault lies largely on the shoulders of the cost men themselves, who do not realize to a sufficient degree the requirements and problems of the business heads. Consequently, the cost figures which they prepare are not recorded, organized, presented, and interpreted so as to serve exactly the requirements of the men on whom the company's policies depend.

Index Number
657.452 Cost accounting

First Technical Session

Some Practical Applications of Budget Methods. (Tuesday, September 23). Wm. F. Kemp, treasurer of the Holtzer-Cabot Electric Company, Boston, and later elected President of the Association for the following year, was chairman of the session which discussed this topic. The first speaker was W. M. Duncan, Vice-President and Sales Manager of the Hood Rubber Company, Boston, a distributing company, which through the experience of years has reached a satisfactory method of operating a sales budget. This company's budgets are based upon forecasts of probable sales, which in turn are arrived at from a thorough analysis of the possible markets throughout the country.

The second speaker, Arthur Lazarus, of the Metropolitan Life Insurance Company, described a special form of service. His company invests large funds in securities of industrial corporations, in whose well-being it is therefore interested. To serve them, it has developed standard systems of budgeting for sundry industries, which may be obtained on request.

Mr. Kemp presented a paper on the "Practical Installation and Operation of a Budget System". In this he showed how a suitable foundation must first be prepared, which for a manufacturing organization is as follows:

1. An adequate general accounting system.
2. A cost system which ties in with the general books.
3. Perpetual inventory records.
    - (*a*) Raw materials.
    - (*b*) Work in process.
    - (*c*) Finished parts.
    - (*d*) Completed goods.
    - (*e*) Expense materials.
    - (*f*) Plant equipment.

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[1] The complete text of all papers and discussions will appear in the forthcoming year book of the Association.

[2] Author of "Policies for Successful Operation" appearing on pp. 391-394 of this issue.

4. Monthly departmental statements.
    (*a*) Direct labor.
    (*b*) Indirect labor.
    (*c*) Manufacturing supplies, etc.
5. Monthly financial statements.
    (*a*) Summary of factory operations.
    (*b*) Sales, cost of sales, and selling expenses.
    (*c*) Financial income and expenses.
    (*d*) Combined profit and loss statement.
    (*e*) Balance sheet.
6. Complete classification of accounts so arranged that budgetary estimates can be compared monthly with actualities.

A questionnaire had been sent by Mr. Kemp to about 20 experienced members of the Association, who verified the need of a suitable foundation, and agreed in general with Mr. Kemp's plan for it. The answers showed that no standard procedure for establishing a budget had yet been developed. Mr. Kemp suggested:

1. Determine period for which the budget is to be estimated.
2. Estimate sales.
    (*a*) By territories, customers, etc.
    (*b*) By lines of product, units, sizes, etc.
3. Estimate selling expenses, including all costs of distribution, collections, etc. Classify as fixed and variable, and by territories.
4. Estimate cost of extensions, installations, renewals, and replacements, of plant and equipment.
5. Estimate cost of production.
    (*a*) Raw materials.
    (*b*) Direct labor—amount and hours departmentally.
    (*c*) Overhead expenses—detailed departmentally.
6. Statement of estimated cash receipts and payments.
7. Estimated income or profit and loss statement.
8. Estimated balance sheets.

Group Luncheons for Discussion of Topics

Metal Products. The principal topic of this luncheon was standard costs, the use of which in the metal products industry indicates an interesting trend away from the job order system with actual costs of material and labor. In place of the latter there has come into very general use the process cost system, in which the cost cut-off is made at the end of the month and not at the end of any given quantity of product. This system uses standard costs for material and labor as well as for burden, these standards being checked each month (and in many cases weekly and even daily) with the actual consumption of material, the actual expense for direct labor, and the machine activity at normal rates in each of the major departments.

Textiles. It seems incredible that so important an industrial group as the textile industry should not have a thoroughly formulated and generally agreed upon method of costing, and yet the literature of textile cost accounting is undeniably scanty and the definite formulation of common policies is almost non-existent.

The outstanding feature of the luncheon was an inquiry as to the different types of systems at the companies represented by the 40 attending members. It was found that practically all of these plants employ the process cost system with standard costs. It appears, then, that working from basic principles, without common agreement, these concerns have generally arrived at about the same result.

However, it was the consensus of opinion at the luncheon that cost accounting for the widely varying branches of the textile industry has scarcely more than scratched the surface, and it was voted that a recommendation be made to the directors of the National Association of Cost Accountants to hold special sessions of textile cost men in regional conferences.

Paint, Varnish, Chemicals, and Allied Commodities, including Soap. Forty men attended the luncheon for representatives of these industries. The salient point brought out was the need for uniform methods of cost accounting among competing manufacturers. In a questionnaire recently sent out by the cost accounting committee of the paint manufacturers' association, the individual manufacturers were asked to figure and report the cost of a given paint. Nothing was left variable in the question except the cost accounting method. The result showed costs varying from $2.02 to $3.27 per gallon. It was the general opinion that uniformity in cost figuring should be brought about.

Second Technical Session

Some Deficiencies of Cost Accounting and Their Cures. (Tuesday afternoon, September 23). This session was organized by C. R. Stevenson, of the Stevenson Corporation, New York City. The first paper was presented by Professor R. B. Corwin, of Lehigh University, who spoke from the educator's viewpoint.

The second paper, from the point of view of the cost accountant, was presented by G. Charter Harrison,[3] of New York. This paper was a reiteration of Mr. Harrison's sweeping criticisms of defective cost accounting.

The third paper was by Thomas B. Fordham, who is a practical factory man, and as superintendent of the Delco-Light Company, of Dayton, Ohio, spoke from the point of view of the shop superintendent. He felt that the principal deficiency of cost accounting, as far as he comes in contact with it, is that sufficient information is not furnished to the operating executives. He urged strongly that both factory superintendent and individual foremen be furnished with clear, precise, readily understandable statements of the expenses for which they are definitely responsible, including direct and indirect labor, supplies, repairs, and the like. He was opposed to permitting the foremen to be concerned with assessed charges over which they have no control. He made a strong plea for close association between the cost accountant and the factory men, which was warmly supported by the members present.

Third Technical Session

Organizing a Business for Cost Reduction. (Tuesday evening, September 23). This session was organized by John H. Van Deventer, Editor of *Industrial Man-*

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[3] Author of "Working Plans to Realize Profits" appearing on pp. 361-366 of this issue.

agement, who presented a statistical summary and abstract, showing the methods of cost organization, and the use made by executives of cost data, obtained by questionnaires from 160 American industrial concerns, employing an aggregate of 500.000 people. The summary gave the facts on 26 important phases of cost control practice for each of these 160 concerns.

William H. Alden, Jr., of Philadelphia, described an interesting treatment of the cost of idle facilities. His method segregates those items of burden which are fixed or comparatively fixed, including taxes, insurance, depreciation, salaries of supervision and foremen, on the one hand, and the fluctuating expenses on the other. Through an analysis of factory production data, a composite percentage or index figure is obtained which indicates the total production activity of the mill. This percentage of the fixed items of burden is written off to profit and loss as the cost of idle facilities.

Fourth Technical Session

The Proper Treatment of Variations from Standard Costs. (Wednesday morning, September 24). This session was organized by and had as its chairman Frank L. Sweetser, of the Dutchess Mfg. Co., Poughkeepsie, N. Y. The subject was one which had been looked forward to eagerly. The proper treatment of variations from standard cost is a subject of particular interest at present. There is, first, a "debatable question" as to the principles of accounting for variances from standard cost in the abstract, and the possible modification of these principles in the face of particular conditions affecting a given industry. Second, there are different methods for the practical handling of the variations.

It is difficult to comment on the papers. All three of the speakers seemed to agree with the principle advocated by Mr. Sweetser himself, that variations from standard cost should be treated by statistics only and that inventories should invariably be carried at actual costs, a principle which certainly is not generally agreed to by all cost accountants.

C. O. Wellington, of Boston, called attention to the fact that for each element of cost there is a quantity and a price variance; in material, representing differences in the quantity of material consumed and the price paid for it; in direct labor, not only in the rate of output, but also in the rate paid for wages; and in burden there is an expense variation and a further variation due to differences in rate of output of product.

Mr. Camman, of New York, brought out the following idea. Where standards are changed the value of comparison between old and new costs is lost. To preserve the comparison, he suggests the use of adjustment factors by which, although the standards are changed, the relationship may still be shown.

Fifth Technical Session

Some Debatable Points in Cost Accounting Theory. (Wednesday afternoon, September 24). This session was organized and presided over by C. H. Scovell, of Boston, and consisted entirely of a warm discussion of four out of seven debatable points, the arguments on which were given in a synopsis previously prepared.

1. *Should administrative expense be charged against manufacturing cost?*

The debatable point, in brief, was whether items ordinarily considered as administrative expense and retained separately under this classification should remain in a separate classification, or whether this bracket should be entirely eliminated and all of these expenses distributed either to manufacturing cost or through selling expense. After lengthy and vigorous discussion the meeting voted overwhelmingly to retain the administrative expense bracket.

2. *Which cost should be obtained: Cost to make, or Cost to make and sell? How differently would that question be answered if the goods are sold before they are made?*

There are several debatable points under this heading. The meeting voted that in the operating statement, selling expense should be stated separately *after* gross profits, and excluded from the cost of goods sold.

It was also voted, that this method should hold good even in the case of a plant manufacturing two lines, one made only on special order and the other made to be distributed from stock, with selling expenses determinable accurately against each line. As a corollary to this decision, the cost of obtaining a definite order is not part of the work-in-process cost of the order and cannot be carried on the books as such.

On the other hand, the meeting voted that an initial engineering charge, as in the case of engineers sent out to take measurements for a certain installation, is a part of work-in-process and accordingly should be retained on the books as an inventory item.

The meeting voted to distribute selling expense in a seasonal business throughout the fiscal year, and agreed to the use of normal rates for selling expense (and also for administration and financial charges), retaining either prepaid or accrued balances on the books.

3. *At what point should the stock handling and storage charge be applied to materials? Upon receipt? Upon consumption? Any other basis?*

That is, should stores be carried on the books at actual cost, plus a regular stores charge, even though the latter contains a certain amount of expense which will not be incurred until the goods have actually passed into production, thus causing a slight inflation of the inventory. The vote was, No. This does not prevent the carrying on the books, separately from the detailed stores ledger, a prepaid item of freight handling, storage, etc., which is liquidated as the goods move into production.

4. *What production should be taken in determining normal burden? Is it full production capacity, or the best accomplishment according to some past record?*

As a preliminary to the main question, the point was made that before establishing a normal burden basis from the point of view of factory operations, consideration should be given as to the position of the industry as a whole. In some industries the plant expansion during the war has left a producing capacity far in excess of any possible present consumption of goods. In such cases it is obvious that the treatment will not be the same as when orders should be taken, on the average, for the full capacity of the plant.

Following this, the meeting agreed that in setting the normal burden rates, there should be deducted from the 100 per cent, which represents the hours when the factory is open for business, allowances for the following items which are considered undebatable:

Holidays
Repairs
Industrial contingencies

The following points were considered debatable:

Seasonal activities, as in a cannery, which must operate only a small portion of the year.
Special service machines, which cannot possibly operate as much as the regular installation.
Unbalanced equipment.

Sixth Technical Session

Selling and Administrative Costs, Their Definition, Analysis, and Distribution. (Thursday afternoon, September 25). This, the last technical session, was organized by W. O. Cutter, Comptroller of the United States Rubber Company, New York City.

W. A. Johnson told how the B. F. Goodrich Company distributes selling expense, with a master summary expense statement, which is supported by more detailed statements showing assessment against the different kinds of product. These detailed statements give the actual expenses, the budget expense percentages, and also the sales percentages, comparison of which indicates the point of attack for reducing charges.

C. L. Landon urged the cost department to "sell" the sales department on the use of the statistics. He suggested a cost analysis (in the case of large distributing organizations) of dealers' accounts, for the purpose of eliminating unproductive dealers. Such an analysis makes it possible not only to obtain more business but to get more profitable business. Mr. Landon stressed the idea that the sales department will not, and perhaps is not able to ask the cost department for all the information which it needs, and the cost department ought to do this thinking for it.

The final paper was by William Carswell, of the Northern Electric Company, Montreal, who is chairman of the Canadian Chapter of the National Association of Cost Accountants. Mr. Carswell's paper on administrative expense was one of the best and most carefully prepared papers of the convention. He gave as charges appropriate to administrative expense:

1. Executive expense. Salaries of president and corresponding office force.
2. Financial expense. Salary of the treasurer and treasurer's department, including the expense of financing, and supervision of the credit department. In some cases the credit department is included in this classification.
3. Corporate. Secretary's office. Corporation taxes (excluding property taxes). Legal expenses.
4. Accounting. Comptroller. General accounts. Tax returns.
5. Development expense. Experimental work.

Application to Cost of Product. The customary method of applying administrative expenses to the product is at a uniform percentage of the sales price for all goods. It should be possible to distribute these expenses over the main line. To do so it is necessary to analyze in detail the functions performed by the various officers and apportion them accordingly. Routine work can usually be distributed in proportion to the amount of work handled. From this analysis normal rates can be developed, which should be based upon a complete cycle of business.

Control of Expense. Administrative expenses have increased materially in recent years and may easily get out of bounds. Most of them are controllable. There should be periodical statements of actual expenses compared with predetermined budgets, and the comparisons should include the number of employees in each department.

The cost is generally in proportion to the number of employees, and the problem then is to reduce the force itself. Analysis for this purpose will probably indicate unnecessary functions. To be sure, a proper system is required, but often, as a business grows complex, a man is assigned to a special function, which grows until a new department is formed, the expense of which may grow beyond the benefits derived.

Reports and Statistics. The reports and statistics should give the right facts and all the facts to just the right people. It is the cost accountant's duty to interpret them to administrative and selling departments. Each expense should be tested, for it must either increase revenue or reduce expenses, or else it is unnecessary.

C. O. Wellington, of Boston, made a final appeal for the thing that had not been touched on in the previous papers—that selling, administrative, and general financial charges should be calculated for a normal budget in the same manner as manufacturing burden items, and normal rates determined in a similar way. The closing hour had arrived, so there was no chance for further discussion of this interesting point.

Cost accounting work in selling and administrative expenses stands today about where manufacturing cost accounting probably stood in the dark ages of 10 or 15 years ago. It is obvious that the same principles may be used and normal rates determined in the same manner, but there is a scarcity of experience. More light is needed on the practical use of principles.

The Net Result

One carries away from the convention, even after the blood has cooled, a definite feeling that the whole subject is tremendous. So much can be done in the way of service to American industry that what has been accomplished has little more than scratched the surface. Cost accounting may be on trial today in many companies. We may have missed the essential requirements of the man at the top. There is another dialect which we must learn. But if the future is half as successful as the past, the ultimate position of modern cost accounting as a vital factor in the administration and progress of American business is assured.

Dividends for Dull Times

From Savings in Power Plant Operation

By DAVID MOFFAT MYERS

Consulting Engineer

A PLANT owner can make money when business is flourishing, and he can do it without any particular worry about economical operation. His problem then is production volume, and this frequently means plant extension and increased equipment to meet the demand of the market. The greater the production, the lower the unit cost; so that as a business grows, a certain degree of economy follows naturally and inevitably. But when dull times return, the volume must be reduced and the unit cost goes shooting skyward by reverse process and under the same mathematical law that brought it down when business was good. Yet, now, more than ever, is low unit cost needed in the face of a strong buyers' market which knocks prices into a cocked hat.

This situation in our present dull times is all the more aggravated by the fact that most manufacturing plants are already vastly overexpanded. They are equipped to carry on, not on a normal business basis, but to pour forth an output capable of meeting that short period post-war boom market which was responsible for their overexpansion. Many a plant is now operating on one-quarter to one-third or one-half of its potential production. To put it mildly, overhead costs are too high.

Application of Economy

A remedy is urgently needed. And the only one possible is the application of economy in all departments. Economy means scientific expenditure of money and energy in such manner that the return in savings shall be great in comparison with the expenditure.

There are ways of saving without the outlay of anything but brain energy, and this leads to the broader statement which covers the whole field of economy. Economy can be secured only along two lines of endeavor. (1) improvement in physical equipment; and (2) improvement in methods of operation. Translated into other terms: efficiency is the product of the equipment-efficiency times the human-efficiency. Thus if your machinery, when perfectly operated, is capable of 90 per cent efficiency, compared to the best, and if the men who operate it are only 60 per cent efficient, the over-all result will be 60 per cent of 90 per cent or 54 per cent. Thus without change in your plant, if you but bring your human factor up to 100 per cent efficiency your over-all economy will jump from 54 per cent to 90 per cent.

This truth applies to every kind of production in which men and machinery are involved. The resultant efficiency is the product of the two elements, never the sum. This means that if you improve methods (with the same equipment) 25 per cent, the over-all result will be improved by the same percentage. This is the side of the economy program which is so attractive and deserves emphasis in dull times—the human side, the operating side of the equation. And the principle is applicable to every department of manufacturing.

Index Number
658.26 Power plant operation

While, for 23 years I have visited industrial plants, large and small, in all the principal lines of production, I can claim only the most general, and often superficial, knowledge of manufacturing in its numerous phases and departments. My whole attention has been concerned with the question ordinarily known as the "power problem" which necessarily also included consideration of heat for processes and buildings.

Cost-Keeping Records Maintained and Carefully Watched

During this period of industrial plant visitation, I found in general that lively interest was manifested by the management in methods and machinery for reducing the cost of operation in the various production departments. In connection with all of this development, cost-keeping records were maintained and watched with great care. The power plant department, on the other hand, was considered non-productive, a necessary evil, and was left to take care of itself in the majority of cases. Moreover, I found the reason for this practice. The cost of power and heating, except in the case of heavy power and steam users, was usually a relatively small percentage of the total cost of operating the whole works. Consequently, and logically, too, when the management was casting about for means to reduce the cost of production, it naturally tackled the most costly departments first and let the others wait.

This practice has now been in effect for a great many years, at least the 23 with which I am familiar, and it has inevitably led to the situation we have today all over the country with, of course, the usual exceptions to "prove the rule". Thus today industry is loaded down with inefficient power and heating plants. Inefficient because of two factors: (1) faulty design of plant including worn-out or inefficient equipment; (2) antiquated methods of operation.

While this, perhaps, is unfortunate, it presents a wonderful opportunity for reducing the cost of operation at a time when it is most welcome, and a few owners have been long-sighted enough to see it.

Although the logical time to spend money is when money is not being spent, there is a widespread feeling to the contrary. The average owner spends only when he is making large profits. Here again is a great chance for the owner who wants economy without capital expenditure. For by scientifically digging into the question of operation alone (without new equipment) a mine of wealth can be unearthed. You may own a fine motor car, but if you do not run it properly you cannot get a fine performance, and the same thing is just as true of your power plant.

Possible Savings

In one large plant a change in method of operation produced a saving of a quarter of a million dollars a year. No new boilers or turbines or other equipment, except minor piping changes, were needed in order to make the best use of exhaust steam.

In one small two-boiler plant which had been unable to maintain steam with both boilers and with dampers wide open, a change in method of handling fires resulted in full operation with a single boiler, damper half-shut, and 50 per cent more steam per pound of coal.

These are only two interesting examples of the great opportunities for creating dividends for dull times. Almost everyone thinks of machinery or equipment when his mind turns toward improvements. He thinks of the inventions and mechanical developments of our generation. These have been marvelous indeed, but most people fail to realize that along with this progress, so notable in the field of mechanical and electrical apparatus, there has occurred a wonderful growth in knowledge of operation, of improvement in methods of utilizing existing equipment.

Almost everyone is approachable on the question of a new machine. He can play with the model and can see the machine work. Very little imagination is needed to visualize the results securable by the adoption of a demonstrable machine. The average man falls for it. I have observed numerous sad cases of this blind faith in apparatus without a corresponding understanding of operation. Many a stoker-fire have I seen which could have been beaten 50 per cent with common, ordinary flat grates and a good fireman. Why is it that so much brains and money have been expended on machinery and little or none on learning the best way to run it? Well, whatever the answer may be, there is the fact to face. And on the whole it is a rather pleasant and interesting fact in these dull times. For nearly every industrial plant in the country can today switch the emphasis from apparatus and machinery to men and methods, and thereby save thousands of dollars to make dividends for dull times.

Correct Methods of Operation

I recently visited one of the finest powdered-coal burning central station plants in the world. It represents the last word in modern and efficient equipment. But the management had not stopped there. It had given the most careful study to methods of operation and the human factor. These two are inseparable. A scientifically designed bonus system maintains the continual interest and attention of the operatives who receive additional pay for results over a fixed and reasonable standard of performance. This plant is breaking records and is ahead of other plants with equal equipment which have neglected to study and apply the correct methods of operation.

In a very large industrial plant I recently found stokers of an antiquated and inefficient design being operated for the daily load, while across the firing aisle were modern stokers standing idle. A gross case of inattention to matters of operation. Correct operation will save enough coal to pay some dividends in these dull times. Yet similar cases of equal importance are the rule rather than the exception. Too often in a plant, custom and habit and old tradition, instead of modern knowledge and scientific methods, govern operating conditions.

It frequently requires an outside viewpoint to discover these easy savings. The men in the plant live too close to the job to have a perspective view, and usually they are reticent about suggesting changes. Old power plant tradition tells them to maintain steam pressures, keep the plant running, attend to repairs, and that is all. Innovations and changes are left to others who are occupied with many affairs, and nothing happens, the old methods remain.

Saving 10 Per Cent on Purchase of Coal

When cost of operation is reduced by simple changes in method, little or no money need be spent except for determining what ought to be done. The interest returned in savings on money so expended often runs upward of 500 to 1000 per cent per annum.

It would seem almost needless and foolish to say that all such improvements should be at once determined and put into immediate execution. As a matter of fact, however, this does need to be said and said twice. Needless waste is going on all the time. Much of it can be stopped and turned into dividends simply by finding out where it is, its cause, and how to correct it. An intimate knowledge of right methods in the operation of the power plant will often save as much as the purchase of new equipment, *and without capital investment.*

In another plant I recently found poor coal being purchased for the price of good coal which was available. Here a saving of over 10 per cent of the annual coal bill could be secured without capital investment. Merely a matter of method and system.

In almost every industrial power plant a large and unnecessary waste is constantly occurring due to lack of method and system in the control of combustion in the boiler furnaces. This applies equally to hand-fired and stoker-fired plants. This correctible waste varies from 5 to 40 per cent of the fuel consumed. It is not enough to have installed steam flow meters and boiler-house instruments. Method must be applied and a definite system developed to make these instruments pay dividends. The installation of meters will add nothing to efficiency, unless followed up with a well-thought-out system for their application and use. And such a system must be applied with great judgment to accommodate it to the needs of the local conditions and more especially to the personnel of the operatives. Each plant presents a special problem of its own which must be correctly analyzed and determined.

Waste Due to Meters Out of Order

Many a plant have I visited where the meters were all out of order and doing no good whatever, for the simple reason that when they were purchased no method or system was installed at the same time to provide for their continuous and intelligent use. As a rule, no scheme is worked out to maintain the interest of the men in the meters or to teach them to secure the results which, after all, the meters can only measure. So here again waste is going on, not for lack of equipment, but because of neglect of the human factor which controls operation. Here is a great, almost untouched, field for practicing economy in dull times when capital expenditure is usually not on the program.

Twenty-five million tons of coal per year were saved during the war without changing the power equipment of the industries and railroads. The whole trick was performed by introducing better methods of operation of existing equipment. It required an organization of experts to "put it over" for the campaign was chiefly one of education plus inspiration of owners and operatives. Only the very simplest of measures were adopted and the program was in effect for a very short period. Similar measures intensively carried out in the average industrial plant today, under the supervision of competent authority, would pay big returns.

As a people we have been trained to think of efficiency in terms of machines. We forget that the best machine is only as efficient as the man behind it.

The same man when properly taught and given a real interest in the result he produces will add as much as 50 per cent to his former efficiency. As for the owner, another department of his plant will be raised to the level of modern operating methods, and he will have some dividends to help out in dull times.

Power-plant improvement might well be classified from the investment standpoint:

1. Improvements in method which may pay for their cost perhaps 10 times each year.
2. Improvements to correct simple outstanding defects in plant design or equipment, but which often pay for their cost inside of a year.
3. Improvements in design or equipment of more radical and extensive nature which bring large returns in economies produced, but which require a longer period of possibly one to four years to pay for themselves.

These are all of interest to the owner and any plant study should include a survey of all three classes of investment possibility. But at the present time the first class presents very strong attractions. It offers an opportunity which has been largely overlooked in the majority of industrial plants, and strongly suggests the advisability of converting a great waste into a corresponding economy. The study of plant methods has kept pace quietly with the progress of invention and improved equipment, but its practice has fallen 20 years behind. You have modernized your equipment. Why not modernize the men and methods behind it?

Handling Crated Automobiles

Index Number
658.281 Mechanical handling

ANOTHER way in which mechanical handling equipment is being used to increase the speed and lower the costs of handling material is in transferring boxed automobiles from gondola cars to the docks in San Francisco.

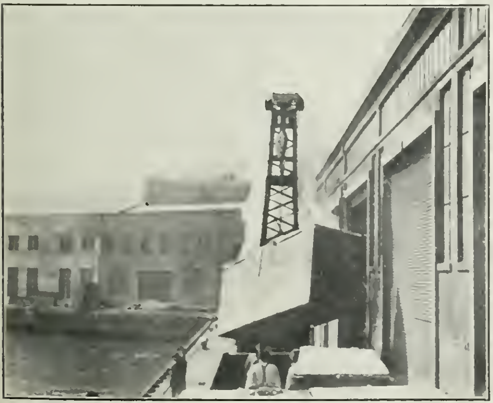
FIG. 1 LOCOMOTIVE CRANE UNLOADING BOXED AUTOS

Before mechanical equipment was installed a boxed automobile presented a difficult handling problem. The boxes were very heavy and so large that any attempt to move them by hand was not particularly successful. The number of men necessary was large inasmuch as each box had to be lifted from its bed by main strength. Even with a large gang of men it required about four hours to unload a gondola car containing six boxed automobiles.

After the crane was installed the number of men necessary to unload a car was reduced to three, and a car containing six automobiles can be unloaded in 25 min. A cable is slung around the center of each box as shown in the accompanying illustration and then the box is lifted out by the crane.

Small trucks or trailers are run to the open door of the docks and the crane swings its load around and deposits it on the truck. Inside the dock house electric tractors are used to haul the trailers carrying the boxed automobiles to their proper places of storage.

Use of the crane has greatly increased the unloading capacity of the dock equipment.

THE EDITORS' PAGE

Better Management Through Budgeting

IN selecting "Better Management Through Budgeting," as the slogan for Management Week, October 20 to 25, 1924, the committee representing the five national associations planning the annual observance has hit upon a topic of real, live interest. There are concerns which still pin their faith blindly on the old hit-and-miss scheme of operation. But this "old school" is fast passing away, and with its disappearance will go much of the waste in business, high industrial mortality, and violent fluctuations in the business cycle.

Business sense and sharp economic necessity have brought about a new method of planning for the future to conserve and increase the gains of the present. That method is budgeting.

The budget is a mechanism big enough to guide the financial affairs of the nation and save hundreds of millions annually. It is small enough to be applied to the running of an ordinary household and economize in dollars and cents. Between these wide extremes it has been applied with invariably successful results to every form, kind, and size of industrial enterprise. Backed up by this record of actual experience, it needs no further justification.

Articles by Joseph H. Barber, Edward H. Tingley, and J. L. Palmer in the present issue of MANAGEMENT AND ADMINISTRATION show how budgeting, or planning the entire operations of a business for a definite period in advance, has been applied in detail to successful present-day companies. Administration, financing, accounting, engineering, shop production, selling, advertising, and every other form of industrial activity in individual plants, have been definitely mapped out and fully co-ordinated for a year ahead. This program has been split into quarters and months, and then has been *lived up to or bettered* in actual practice. These authors even go so far as to call the budget a business forecast and a means of pre-estimating profits.

G. Charter Harrison, in his opening article of a series starting this month, likens business operation to the following of a navigator's chart. The same simile is applied by Mr. Tingley to the budget, and by Mr. Franklin, in his article, to planning out the affairs of an enterprise.

The importance of budgets and working methods of their compilation and use have formed leading topics in many articles appearing in our magazines during the past four years. During the same period we have also published several books dealing with the subject, among which are those by James O. McKinsey and Stuart P. Meech, J. H. Bliss, Thomas B. Fordham and Edward H. Tingley, and a section of the "Accountant's Handbook". In addition, "Management's Handbook," coming from the press simultaneously with this issue of the magazine, devotes a special chapter to the important subject of budgeting.

Management Week deserves the enthusiastic support of executives in every one of the 65 centers where meetings have been planned in the interests of "Better Management Through Budgeting".

Is Money Cheap?

MONEY measured by interest rates is cheap. In June 1920, the commercial discount rate of the Federal Reserve Bank of New York was 7 per cent. In June 1924 it was 3½ per cent, and has since gone down to 3 per cent. In June 1920, railroad equipment trusts—the most highly esteemed form of railroad security—were quoted on a basis of 6.50 to 8.75. In June 1924, the quotations ranged from 4.80 to 5.70. In June 1920, a bond as good as the American Telephone and Telegraph Collateral Trust 4 per cents sold to realize 8 per cent. Today they are within 3 points of par, and yield but little more than 4 per cent.

And money is plentiful as well as cheap. Is it then wise for the manufacturer to avail himself of the present cheap and abundant supply of money to modernize his plant—to put up new buildings that will permit of future expansion, replace old equipment that will soon be obsolete, add new equipment that will increase his output?

The usual and unthinking answer to such a question is an emphatic "*Yes!* Do it now! Money will never be cheaper." Probably money never will be materially cheaper, as measured by interest. But interest is not the only consideration. The problem is not so simple. The purchasing power of the dollar must also enter in, if the picture is to be complete.

In 1913 the purchasing power of the dollar was at a peak—or looking at the matter from the other side, prices were exceptionally low. Considering the prices of this base year as 100, these prices rose with a fluctuating curve until in 1920 they were over 250. That is, the dollar in 1913 would buy more than 2½ times what it would in June of 1920. From this high point prices fell rapidly until today they are in the neighborhood of 150. It is obvious, in any question of financing for future needs, this purchasing power of the fluctuating dollar must be considered and may cut a much larger figure than the actual interest rate.

If prices are to recede still further a present-day financing might be a very costly one in spite of the low price paid for the money. Securities sold now must be redeemed later and if at the redemption date prices had receded to the 1913 level, these same securities must be paid for in dollars worth—or capable of purchasing—one-third more than the dollars received for them.

Obviously the purchasing power of the dollar may and does, in many cases, bear very directly on the expediency of present-day financing. If the matter is the optional replacement of outstanding securities carrying a high rate of interest by an issue of securities carrying a lower rate of interest there can be no discussion. When Kennicott Copper Corporation calls for payment November 1, 1924, of $15,000,000, 7 per cent bonds due February 1, 1930, borrowing in part at least the required sum, "the difference in rate paid on the borrowed amount means the saving of a tidy sum".[1] The manufacturer might indeed be justified in refunding his high rate obligations at the present low rates even though he must pay a premium for the privilege. It is all easily figured out. In either case the payment is a future one and the purchasing power of the dollar need not necessarily enter in.

Also if a manufacturer has obligations falling due for which his cash on hand is insufficient, he must borrow regardless of either interest rates or the purchasing power of the dollar. Again, if his housing is so inadequate, or his equipment so obsolete as seriously to handicap production, or if by additional equipment or expenditures he can increase production or otherwise avail himself of the fruits of "science and invention," the advantage, or perhaps the necessity, of doing "what should be done" is so great and so obvious that neither the price of money nor its purchasing power enter seriously into the consideration—the manufacturer is glad to get his money at a low rate, but he would get it just the same if the rate were high.

When, however, the manufacturer is looking towards the morrow, when he thinks of borrowing money for future needs; when he thinks of doing now what might as well be done in the years to come because money is cheap; then he must give careful consideration to the fluctuating value of the dollar. If he does not his cheap money may prove to be very dear.

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[1] *Wall Street Journal.* September 11, 1924.

Practical Industrial Psychology

INDUSTRIAL psychology is one of the newer factors being studied by management. Unfortunately, however, the impression received by many executives has been based on material either of a theoretical nature, or which has been presented by amateur psychologists whose enthusiasm has outweighed their information and judgment. There is, however, a real opportunity for industries to solve some of their most perplexing human problems through the medium of psychological studies. These studies must be based on actual industrial conditions rather than on laboratory tests so that the co-operation of industrial executives with psychologists is essential to obtain worth-while results. Many concerns are already doing this and have found it to be a very profitable venture.

As an example, in this issue B. P. Campbell describes the work being done at the Lynn Works of General Electric Company. The particular problem studied was fitting workers to jobs. A noteworthy fact is, that based on psychological theory, 50 tests were devised. When subjected to checks to prove their practical value 45 were discarded. It is in this way that psychological principles must be adapted to industry. Many theories will need revision or will be discarded, but enough will fit actual conditions to make the studies of real value.

In the case referred to the results have been quite satisfactory. At the April meeting of the Taylor Society, Johnson O'Connor, who is in charge of the studies at Lynn, said that during the previous seven months results of their tests had been about 50 per cent reduction in labor turnover. Such an achievement is well worth striving for by every business. Psychology has been and can be again used to earn profits for industry.

Executive Ignorance

ASTOUNDING as it may seem, the executive head of one of our great aggregations of enterprises has confessed that he had to make an effort to find out that his employees wanted such a simple thing as continuity of employment.

In an article in *The New York Times,*[1] L. F. Loree, President of the Delaware and Hudson Company and its 34 affiliated or controlled companies, is quoted as saying:

> Then we tried to find out what the men set most store by. Lyndon Mac-Assey, an English writer on industrial relations, has said that the three things the industrial worker is concerned with are continuity of employment, better conditions of labor, and recognition of the human status. The second and third of these are somewhat nebulous, but continuity of employment is a definite term, and we found on inquiry that the men were more concerned about this than anything else.

One of the great difficulties in management today is the lack of knowledge on the part of those who control industry as to what is in the minds of the workers. Yet a casual inquiry will show what their desires are, or a reference to management literature will bring the information.

To cite but one source: John Calder during the war formulated the "five wants of employees". They were widely printed and quoted at that time, and have been repeatedly reprinted since.[2] They are:

1. A steady job.
2. Adequate real wages.
3. A good foreman.
4. An individual and collective voice about his conditions.
5. A chance to rise.

These five points are a simple statement of simple desires. Yet there is gross ignorance of them on the part of managers and equally gross ignorance as to the true basis of business on the part of workers. We can forgive the men, but not the management.

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[1] Sunday, July 20, 1924.

[2] See, Report of American Foundrymen's Convention, Philadelphia, 1918. Report Silver Bay Conferences 1919 and 1920; "Nom-Coms of Industry," in *The Saturday Evening Post.*

NEWS OF EQUIPMENT
FOR THE MANAGEMENT

This department is conducted to give our readers essential facts regarding items of industrial equipment recently placed on the market, that may be used to increase production or lower costs. Each item is indexed according to the Dewey Decimal System so that it can be accurately filed for future reference. The editors will be glad to furnish additional information about any item. All information given is obtained from reputable manufacturers, and MANAGEMENT AND ADMINISTRATION accepts it as reliable.

New Design Diesel Engine

**Index Number
621.434 Diesel engines**

THE Worthington Pump and Machinery Corporation has developed a new design of two-cycle, double-acting Diesel engine which offers several advantages over existing types of internal combustion power machinery. The new engine combines fuel and operating economy comparable with that of the best existing types of Diesel engines, with dimensions, weight, and construction costs approaching those of reciprocating steam machinery. The manufacturers claim that present indications are that horsepower per cylinder can be carried to a much higher value in the new engine than has yet been obtained in Diesel engines, thus making it an active competitor over a much wider range of steam-power machinery than has been possible before with Diesel type power. The first unit built has been rated at 600 to 800 hp. for a single cylinder unit at speeds of 90 to 120 r.p.m.

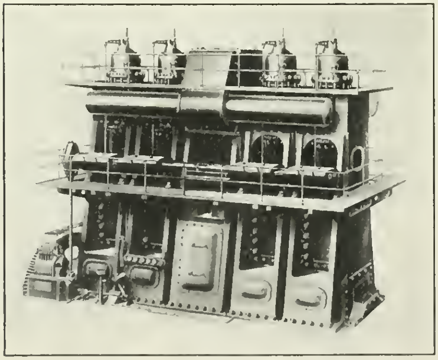
FIG. 1 TWO-CYCLE, DOUBLE-ACTING DIESEL ENGINE

The underlying principle of the engine is its cylinder design, which is so constructed that every stroke is a power stroke, making its working cycle virtually the same as that of a reciprocating steam engine. The cylinder may be described as being composed of two single-acting cylinders, opposed end for end and working in opposite directions, their respective pistons flanged to the same rod, but ports, cooling system, and expansion provisions being independent of each other.

Three fuel spray valves are arranged to give uniform distribution of the charge around the piston rod. Each valve has a cam, all geared to a common shaft which is connected, by a worm-shaft and oil-operated hydraulic mechanism, to the reversing lever. Reversal of running direction is accomplished by moving the reversing lever so as to move the cams through a 34 deg. angle. Starting and stopping is also accomplished by a single lever which operates the air-starting and fuel-supply valves. Starting and stopping, and reversing levers are interconnected so that the engine must be brought to a full stop before reversing.

Worm Box

**Index Number
621.83 Gears and gearing**

A DOUBLE thrust worm box for use with open worm gear drives, when something less expensive than a completely enclosed unit is desired, is being manufactured by W. A. Jones Foundry & Machine Company. It provides an accurate and rigid support for the worm shaft and holds a liberal supply of oil in which the worm operates. Thrust washers consisting of a hard fiber washer between two steel washers are provided at both ends of the worm. Bearings are babbitted, and bored and faced on ends. Boxes are made in standard sizes to fit standard cut-steel worm gears made by the company.

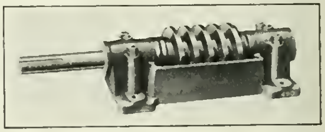
FIG. 1 DOUBLE THRUST WORM BOX

Spot Welder

**Index Number
621.392 Electric welding**

AN electric spot welder designed specifically for hard and steady service is being manufactured by The Taylor Welder Company. It

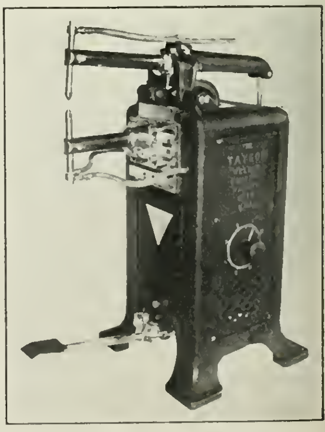

FIG. 1 ELECTRIC SPOT WELDER

has been reinforced at wearing points, parts have been reduced to a minimum, and accessibility and convenience have been considered throughout its design so that it will meet the needs of continuous duty and strains of everyday service with a small amount of wear.

This new "X" Type welder has 7 features that are being emphasized by the manufacturers: (1) water-cooled transformer; (2) automatic switch requiring no adjustment for wear of welding electrodes or for variation of thickness of material welded; (3) adjustable foot treadle; (4) quick change, adjustable stop for controlling travel of upper electrode; (5) built-in tool box, with lock, at left-hand side of machine; (6) one-piece base providing rugged construction and neat appearance; (7) new design horn-raising lever with adjustment for upper horn either in or out, as desired.

Belt-Conveyor Pulley

Index Number
658.281 Conveyors

Carriers for conveyor machinery are being manufactured by the Stearns Conveyor Company, for which the following advantages are claimed: saving of power by use of anti-friction bearings and light-weight pulleys; prolonged life for belts and carriers; reduced maintenance and lubricating costs; and reduced shut down time.

Shell of the pulley is made of pressed steel, light in weight but stronger than cast iron, with rounded edges to prevent cutting of belt. Inside the shell is secured a one-piece tube chambered to receive 2 anti-friction bearings. Inside the bearings is a hardened steel shaft which is held stationary on brackets on the frame. A space is provided between the shaft and the tube to hold a supply of grease which is forced in under pressure through the hollow ends of the shaft. Enough grease to last 6 months or a year can be forced into the grease chamber.

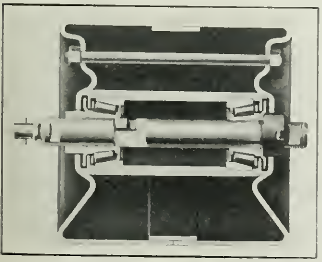

Fig. 1 Belt-Conveyor Pulley

Foreman's Steel Desk

Index Number
621.233 Desks

An all-steel, adjustable desk for use by foremen in the factory is being manufactured by Angle Steel Stool Company. It is intended for "stand-up" use and has adjustable legs by means of which its height can be regulated to fit the user. A range of 9 in. is possible from a front height of 37½ in. to 46½ in.

Top is 34 in. wide by 28 in. deep. Drawer is 32 in. wide by 26 in. deep by 3 in. high and is equipped with lock and two keys and two handles. Two sliding, removable shelves 34 in. wide by 16 in. deep are provided. Lower shelf is 12 in. from floor, upper shelf is 30 in. from floor and 8 in. from bottom of desk drawer.

On the top of the desk is one long compartment which has at each end a small tray for holding pens and pencils. Above this are 10 compartments of various sizes. Legs and frame are made of 1¼ in. angle steel with riveted joints throughout. Finish is oven-baked, dark olive green enamel.

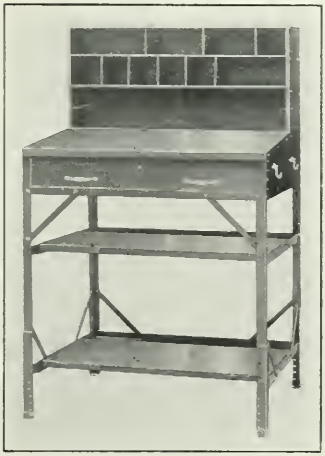

Fig. 1 All-Steel Adjustable Desk

Small Automatic Stoker

Index Number
621.18414 Automatic stokers

A stoker designed to introduce coal—screenings or any coal below the grade of No. 2—into a boiler of 250 hp. or smaller, burn it smokelessly, then care for the ash element by discharging it into a hopper, all automatically, is being marketed by the Stoker Sales Company. Some of the claims made for this "King Coal" Stoker are that cheap fuels can be burned efficiently, thereby decreasing fuel costs; decreased amount of coal is consumed, the amount of ash and unburned fuel is reduced, smoke is eliminated; and its automatic operation provides convenience, safety, and economy.

The stoker is a self-contained unit, adaptable to all heating and steam-making boilers with little alteration. The base of the coal hopper is a reciprocating plate, carried on roller bearings, which has a length of travel up to 5 in. and can be adjusted to feed the proper amount of coal. The grates are terraced. The first and third grates have a forward and backward sliding motion over the second and fourth, which are stationary. This motion causes the coal to travel forward and coking coal can be burned efficiently.

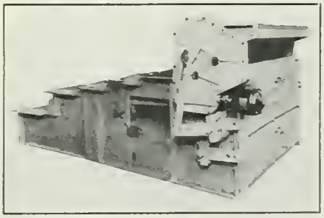

Fig. 1 Frontal View of Stoker Equipped With Motor Drive

The ash plate is directly under the ash opening at the rear and it, too, has a reciprocating motion which moves the ash toward the front although the ash opening is at all times filled with ash to prevent entrance of cold air. By this method practically all of the ash heat is retained and complete combustion is made possible.

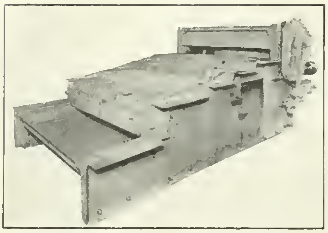

FIG. 2 REAR VIEW OF STOKER

There are only 3 moving parts throughout the entire mechanism so that it is operated by a ¼ hp. motor or hydraulic drive of equivalent power. Either natural or forced draft can be used. During an 8 hr. test of the stoker installed in a 150 hp. boiler of the H. R. T. type burning Illinois screenings under forced draft the following results were recorded: No smoke; 13 per cent CO^2 average; 237 hp. average; 911 lb. water evaporated per lb. of coal fired; 1206 per cent combustible in ash; fuel cost of evaporating 1000 lb. water 26 cents.

Truck Loading Stacker

Index Number 658.281 Industrial trucks

A STACKER which should make possible considerable savings in labor and time in loading motor trucks, and which will reduce idle truck time, has been developed by Lewis-Shepard Company. It consists of a wood platform 80 x 40 in. upon which a lift truck with its loaded platform can be run. The stacker is then raised to the height of the motor-truck body and the load rolled into position on the truck.

These stackers are made in capacities of 500, 750, 1000, and 2000 lb. Three types are made: (1) The hand type is made with a single gear construction on the 500 lb. capacity machine, and with double gears, permitting two speeds, on other capacities—small gears are cut, low pitch gears are cast; (2) Combination type is the hand type with a ½ hp. high torque, elevator type motor installed as motive force. Drive is through spur gearing and roller chain. Control is quick make-and-break, hold-over type, double pole, operator's switch built into the motor base and having a top limit switch to prevent overrun; (3) Heavy power type is driven by a 2½ hp. high torque elevator type motor through chain and sprocket and steel worm meshing with a bronze gear mounted on drum-shaft. Worm is mounted on ball bearings and operates in an oil tight housing. Control is through a standard drum controller connected to the limit stop at both top and bottom and to band brake which is mounted upon the motor shaft. Lifting speed on the 1000 lb. machine is 40 ft. a min., and on the 2000 lb. machine, 20 ft. a min.

All stackers are equipped with plow steel hoisting cable. Frames are structural steel, riveted and bolted. Uprights are 5 in.—6½ lb. channels, other members proportionately heavy. Base wheels are 7 in. diameter and are equipped with Hyatt roller bearings.

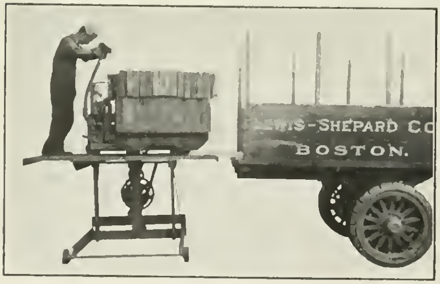

FIG. 1 TRUCK LOADING STACKER

Steel Desks

Index Number 651.233 Desks

A COMPLETE line of steel desks produced to meet the demand for metal desks at a price comparable with that of wood desks is being manufactured by The General Fireproofing Company called the "1600 line". The manufacturers claim they will last a lifetime, will neither warp, crack, check, nor splinter, and are dust- and vermin-proof and fire resistive.

Open hearth steel sheets are used, welded wherever possible to eliminate use of bolts and rivets. No seams or joints are visible. Desks are paneled at sides and back, drawers have hooded pulls, top is covered with green battleship linoleum, and ample knee space is provided. Shelves and drawers are mounted on suspensions which give easy and quiet operation and keep drawers horizontal when fully extended.

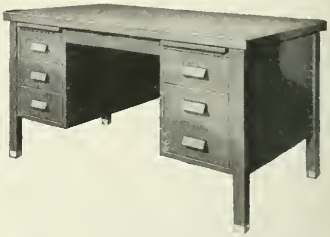

FIG. 1 STEEL FLAT-TOP DESK

The line includes roll-top, flat-top, typewriter desks and tables. They are furnished in olive green or mahogany finish. Sizes are 34 in. deep, 30½ in. high, 45 in. long for single pedestal types and 60 in. long for double pedestal.

Test Indicator

Index Number 621.7163 Measuring devices

A TEST indicator for finding truth of lathe centers, arbors, cutters, gears, etc., for testing alignments of drillpress table with spindle, of tail center and head center, and for similar services is being

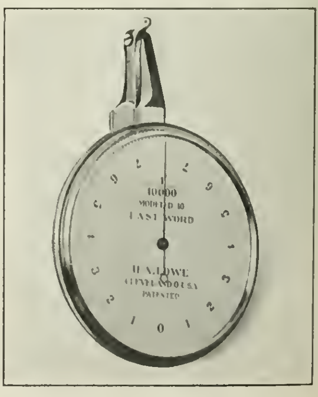

FIG. 1 TEST INDICATOR

manufactured by H. A. Lowe. The construction gives a magnifying power of 100, but the device weighs only 1¼ oz. The dial is graduated and has an adjustable, hardened, taper-head stud for a bearing. The indicator is quickly transferable from surface gage to lathe, shaper, grinder, or milling machine work.

Gasoline Engine

Index Number
621.43 Gas and oil engines

A 4-CYLINDER, 4-cycle, vertical gasoline engine called the "Powermaker" is being manufactured by The Cook Motor Company for heavy and continuous industrial services that require a power unit heavier than the automotive type yet light enough to be portable.

The cylinders are inverted in order to concentrate heavy parts at a low point to gain stability and lessen vibration and also in order to make all moving parts more readily accessible for repair or adjustment. It develops 10 hp. at 1000 r.p.m. on the crankshaft or at 500 r.p.m. when driving from the gear reduction shaft provided on each unit. Cam- and crankshafts and connecting rods are drop-forged steel, bearings are split die cast. Pistons are cast aluminum. High tension magneto, pressure lubrication, and radiator thermo siphon cooling system are used. Fuel consumption is 0.9 pint and oil 0.03 pint per hp. hr.

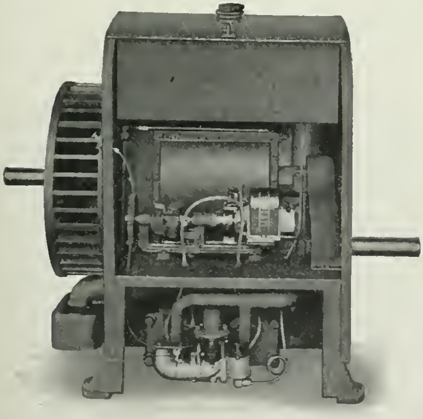

FIG. 1 GASOLINE ENGINE FOR HEAVY INDUSTRIAL SERVICE

Portable Flight Conveyor

Index Number
658.281 Conveyors

A PORTABLE flight conveyor for all services where loose or lumpy materials must be loaded or moved is being manufactured by Gifford-Wood Co. It is particularly designed for handling soft coal and other material having a large percentage of lumps. Its capacity is about one ton a minute when fed continuously and it will handle material containing lumps up to 20 in.

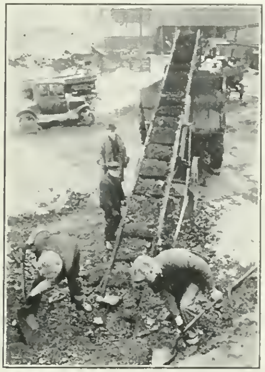

FIG. 1 PORTABLE FLIGHT CONVEYOR

The conveyor is driven either by a 3 hp. electric motor or by a 5 hp. gasoline engine. A steel roller chain connects the first shaft to the motor. Other drive and conveyor chains are malleable grip lock. Flights are heavy steel formed into channel section. Frames are two side channels connected by a removable bottom plate. Control is obtained through a lever operated switch. Heights of discharge are regulated by geared lifting mechanism. Length is 24 ft., width of trough 20 in., weight 2580 lb. Wheels are 48 in. diam. with 4 in. tread. Dot system of pressure lubrication used throughout.

It is driven from the top or discharge end to which an adjustable chute or screen can be attached easily. Loading end is low to require minimum loading effort.

Visible File

Index Number
651.5 Files and filing

A NEW visible record file called the L. B. Speedac, designed for use in every department or service where card records are used, or might be used, is being marketed by the Library Bureau. Its operation is so simple that the manufacturers claim remarkable speed and accuracy can be obtained with untrained clerks.

The card carrier bar is made of hard wood and the hinge, made from Kraft stock, is securely stapled to it. A finger lever releases or locks the cards in the tray by being pushed outward or inward. Card carriers may be inserted or removed with four operations requiring but 10 seconds. Cards are secured to carriers by an eyeletted disc and can be removed or snapped into place in two motions requiring two seconds. The construction of cards, carriers, and finger lever feature assures accurate alignment of the visible portion of each card. For posting, cards are flipped back, lying flat, and the entry can be made on a card which rests on a smooth, even bed. Cabinets are die formed and welded, furnished in green or mahogany finish.

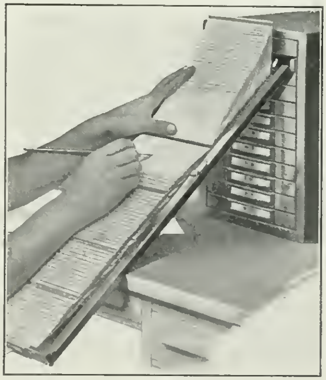

FIG. 1 VISIBLE RECORD FILE

Celluloid protectors for the cards can be furnished. It is possible to use single or double cards, folded sheets, or combinations of cards and sheets. Color signals may be used.

Production Control Board

Index Number
658.5 Production
control

A system of controlling production, which is simple in operation but which provides adequate control over manufacturing processes, is being manufactured by The Service Engineering Company. It is called the Howard Work Board. It was designed particularly for use in the garment manufacturing industry but it is adaptable for use in other fields. Its principal advantage lies in the fact that a minimum amount of clerical work is required for its operation.

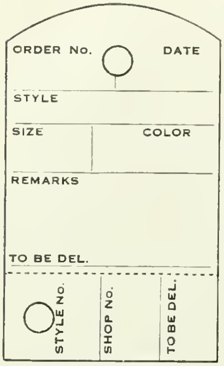

Fig. 1 Order Ticket

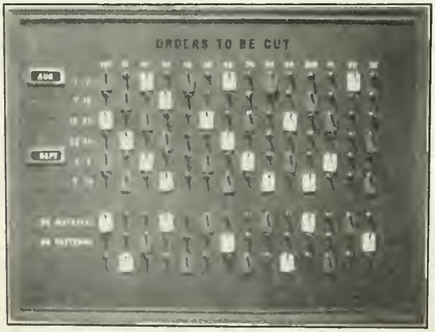

Fig. 2 Cutting-Room Control Board

When an order is received, a ticket (Fig. 1) is made out to show all necessary information relative to the order, including the promised delivery date. This ticket is sent to the cutting-room, where it is hung on the cutting-room control board (Fig. 2) under the style number and opposite the promised delivery date. Should material or patterns be unavailable the ticket is transferred to the bottom of the board opposite the proper notation, where it serves as a constant reminder that work is being held up, and the reason therefor.

When the order is cut the ticket is transferred to the factory work board (Fig. 3) and hung under the style number and opposite the first operation. At the same time a stub is detached from the ticket and is forwarded to the shipping-room where it is hung on a third board (Fig. 4) opposite the delivery date.

The blank spaces under the heading "Contractors" (Fig. 3) are for jobs, such as embroidery, that are done in part by outside contracting firms. As operations are completed on the order, piece work slips or job orders give the information to the person in charge of the board and the ticket for the job is moved down to the next operation. In case work is held up for any reason such as, in the present instance, lack of furs or trimmings, the ticket is moved down in order to remind the foreman of the delay and its cause.

From the shipping-room board the shipping clerk can keep a close check on all orders that they may be delivered on time to meet promised delivery dates. When any order does not turn up at the proper time for shipment, or when checking its progress prior to the shipping date, he can readily locate it on the factory board.

The shop foreman can easily tell if any one operation or department is overburdened with work, for the corresponding row on the work board will show a preponderance of tickets. The head cutter can select orders from his board according to delivery requirements and can group orders for similar styles. The manager can see at all times the condition of work. Inquiries about the progress of an order can be answered easily. Delay conditions are accurately pictured by tickets hanging opposite reasons for delay.

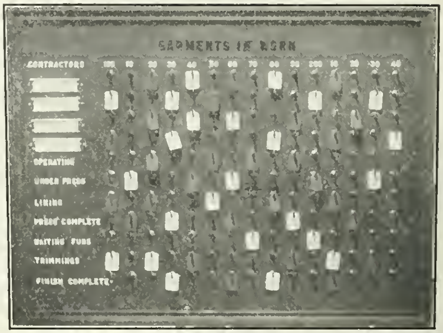

Fig. 3 Factory Work Board

This method of control offers many advantages over book records. Errors and inaccuracies are not so likely to occur and when they do occur are easier to detect upon the board than when contained in book records. An economy feature is the elimination of writing. A single job ticket is made out, subsequent progress of the job is shown by movement of the ticket, and no further writing is necessary.

Where any amount of stock is carried on hand, a fourth work board is prepared and operated. This board shows styles and the ticket gives information about size, color, and quantity. Presence of the ticket shows that garments on the order have not yet been shipped from stock on hand.

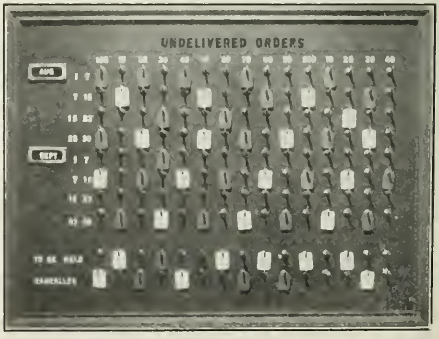

Fig. 4 Shipping-Room Board

Electric Time Stamp

Index Number
651.4211 Time clocks

A TIME stamp that is automatic in operation—insertion of paper making a contact which produces blow and resulting stamp—is being marketed by the Wales Adding Machine Company. Because of its automatic operation, the Insto Stamp always strikes a uniform blow and since the ribbon moves with each operation, impressions made on inserted paper are uniformly clear. Clock incorporated is a 7-Jewel, 7-day, Seth Thomas movement. The stamp operates just as fast as paper can be put into it and prints right side up. It operates on ordinary lighting circuit requiring no special wiring. No master clock, batteries, or other aids are needed for its operation and practically the only cost of its operation is expense of ribbons, which because of the automatic traversing device are said to last at least twice as long as others.

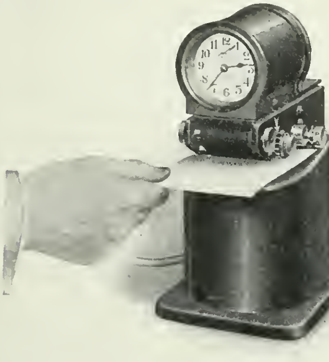
Fig. 1 Electric Time Stamp

Oil Engine

Index Number
621.43 Gas and oil engines

FOOS Oil Engines Type R, vertical, single, and multiple cylinder; high compression, automatic injection, heavy duty are being manufactured for any power work within their rated capacity by the Foos Gas Engine Company. In this type the usual manifold and injection arrangement is eliminated and the fuel injected directly into the combustion space with no pressure on the fuel system except during the instant of injection. Load balance between two or more cylinders is supplied by a measuring pump which supplies fuel to each injector in turn, insuring identical quantities of fuel for each cylinder at each injection.

The engine has been designed to give accessibility to all working parts. All parts requiring manipulation in starting, stopping, or running can be reached from the operating platform. Crank shaft is open hearth, heat-treated steel forged from a single billet. Main bearings are imbedded in the lower base to secure rigid alignment. Connecting rods are forged steel. Crank pin bearing is marine type secured by 4 bolts. Piston pin bearing a solid bronze bushing. Pistons are trunk type, cast extra long to give large bearing surfaces. Cylinder heads are interchangeable. Valves are forged from chrome nickel steel. Practically all working parts are connected with a forced feed lubrication system.

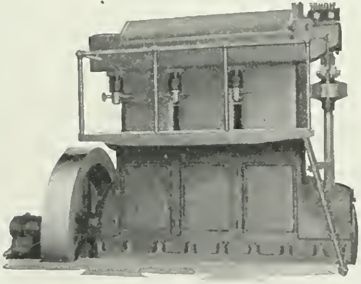
Fig. 1 Type R Oil Engine

The manufacturers claim that this engine marks the success of their efforts to produce a substantial engine with large working parts and bearing which would give reliable and continuous operation, economy of fuel and lubricating oil, and accurate governor regulation.

Posting Ledger Desk

Index Number
651.513 Card systems

A POSTING ledger desk in which from 8,000 to 15,000 cards can be concentrated within immediate reach of one posting clerk is being manufactured by Shaw-Walker Company. It is designed for use by those concerns that have adopted card records in the place of ledgers. Trays can be obtained for various standard sized cards. A movable shelf is provided upon which a card may be placed when an entry is to be made. A roll top covers the card recess and can be locked to guard against molestation of the records.

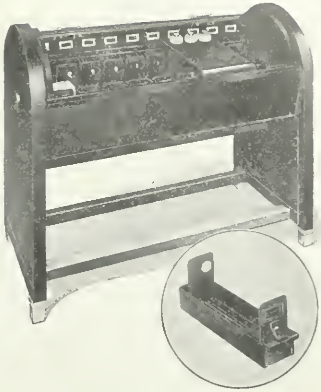
Fig. 1 Posting Ledger Desk

Equipment Catalogs

"Snap-shots of Sensible Savings," a recent publication of the Lakewood Engineering Company, contains illustrations with brief descriptions, showing some 25 different jobs where use of mechanical handling equipment has aided in lowering costs and increasing production.

Hyatt Roller Bearing Company has issued Bulletin No. 1015 on Hyatt roller bearings for conveyors. The bulletin contains general information about the requirements for belt-conveyor pulley bearings and data showing how Hyatt bearings meet those requirements.

The Illinois Stoker Company has just issued a third edition of Catalog L, describing Natural Draft and Forced Draft Illinois Grate Stokers. After complete illustrated descriptions of the design, construction, and operation of the stokers, some 30 pages are devoted to blue-print drawings illustrating their use in connection with the principal types and makes of boilers.

CURRENT INFORMATION INDEX

FOR THE MANAGEMENT

The material indexed in this department is selected by the editors of Management and Administration from upwards of 150 magazines; it also includes the publications of some 50 book publishers and professional societies as far as these are of managerial interest to industrial executives. The items are prepared and classified by the Engineering Societies Library in New York City. The decimal number at the right of each item is the index number and indicates the place the article or book will take when filed in accordance therewith in the classified subject scheme. If articles are grouped according to these numbers, like subjects will automatically fall together and related subjects will follow in logical sequence. Photostat copies of any magazine article indexed will be supplied by The Ronald Press Company at a price of 25 cents the page. When ordering photostats please identify the article by quoting from the index: (1) Title of article; (2) Index number; (3) Name, date, volume number, and page number of periodical in which the item appears. A remittance of 25 cents a page should accompany the order. The books and pamphlets indexed can be procured from The Ronald Press Company or their respective publishers.

Accounting

Accountancy and Its Relation to Efficiency and Peace in Industry. 657.452
Sir Adam Nimmo. *Paper Trade Journal*, July 17, 1924, v. 79, pp. 49-52, 54.

Controlling the Labor. 657.452
National Association of Cost Accountants. *Official Publications*, August 15, 1924, v. 5, no. 23. Direct and indirect labor, records for employment and pay-roll departments, distribution of labor expenditures and necessary labor reports for the purpose of measuring performance. Subject is discussed by W. O. Cutter, C. A. Williams and D. W. Hook.

Correct Costing of Waste. 657.452
R. B. Hobson. *Cassiers Industrial Management*, August 1924, v. 11, pp. 381-382. Simple method of cost accounting with application to scrap and salvage.

Cost Accounting in the Crushed Stone Industry. 657.452
D. J. Hutchinson. *Pit and Quarry*. September 1924. v. 8, pp. 89-92.

Cost Control for the Mechanical Department. 657.452
G. W. Armstrong. *Railway Mechanical Engineer*, August 1924, v. 98, pp. 459-463. Illus. Method applied by the Erie Railroad resulted in reduction of operating costs.

Division Disbursement Accounting on S. A. L. 657.4
L. L. Knight. *Railway Age*, August 16, 1924, v. 77, pp. 287-292. Illus. An arrangement whereby each department of the Seaboard Air Line has its own accounting division with a division auditor in charge.

An Efficient Estimating System. 657.452
L. E. Bunnett. *Engineering Production*, August 1924, v. 7, pp. 220-222. Illus. Details of a simple and workable procedure.

Elements of a Financial Investigation. 657.4
R. G. Davis. Management and Administration, Sept. 1924, v. 8, pp. 277-278. Conditions that call for financing or refinancing of a business and a practical outline of a financial investigation.

Elements of Cost Accounting. 657.452
Anthony B. Manning, C. P. A. McGraw-Hill Book Co., Inc. New York. 165 pp. $2. An elementary study of cost accounting designed to acquaint an interested person with the fundamental principles of the subject. The material is presented by graphic charts which are explained in accompanying text matter. There is also a continuous series of problem data which are representative of the practical work in a cost department of a manufacturing concern.

Estimating Shop Costs for Profits. 657.452
P. L. Dildine. *Industrial Management*, August 1924, v. 68, pp. 119-120. How to compute the cost of materials, overhead maintenance, and labor in order to obtain a more nearly accurate estimate of the probable cost of an article not yet produced.

Executive Uses of Costs. 657.452
Howard Berry. National Association of Cost Accountants. *Official Publications*. September 2, 1924, v. 6, no. 1. p. 11. Accounting information that should go to factory foremen, works managers, sales managers, president and board of directors. Includes a good bibliography.

Foundry Costing. 657.452
S. Howard Witley. *Metal Industry* (London), August 1, 1924, v. 25, p. 105. Pt. 2 of article—Prime cost, total cost, direct and indirect expenses, etc.

How to Find Out if Labor-Saving Equipment Will Pay. 657.452
Belting, Transmission, Tools and Supplies, August 1924, v. 25, pp. 30-34. Formulas for computing the economies of labor-saving equipment.

Importance of the Cost of Idleness in Equipment Industries. 657.452
E. F. Du Brul. National Association of Cost Accountants. *Official Publications*, August 1, 1924, v. 5, no. 22. Management difficulties in obtaining and applying cost analysis so as to prevent violent fluctuations.

Objects of a Cost System. 657.452
W. B. Greenlee. *Foundry Trade Journal*, July 24, 1924, v. 30, p. 71.

A Problem in Joint Cost. 657.452
W. M. Cole. *Paper Trade Journal*, August 2, 1924, v. 78, pp. 53-56. Several problems are given and worked out in detail with a discussion of principles involved.

Use of Appraisals in Determination of the Income Tax. 657.42
S. E. Wardwell. *Paper Trade Journal*, July 24, 1924, v. 79, pp. 53-54.

Advertising

Advertising Appeals Selected by the Method of Direct Impression. 659.1
Richard B. Franken. *Journal of Applied Psychology*, June 1924, v. 8, pp, 232-244. Tables. How this method was studied and applied by several groups of students taking a course in Psychology of Advertising.

The Inner Side of Advertising. 659.1
Cyril C. Freer. D. Van Nostrand Company, New York. 347 pp. $5. The author defines Advertising as "the art of salesmanship on paper, instead of by word of mouth," so this book is a combined study of advertising and selling methods. It is based on English practice, so contains much material that may be new to American readers. Every phase of advertising and printed salesmanship is discussed in a manner which is as interesting as it is instructive. The book contains a great amount of valuable material and is well worth reading.

Mathematics vs. Psychology in Advertising. 659.13
E. T. Gundlach. *Advertising and Selling Fortnightly*, August 13, 1924, v. 3, pp. 32, 66. Study of advertising methods since 1918. "Copy" should make a direct appeal to the prospective purchaser not to the mass of readers.

Selling by the Printed Word. 659.1
Robert Ruxton. *The Printing Art*. July 1924, v. 43, pp. 453-464. Illus. Successful advertising is based on sound ideas and right words.

Shifting Currents of Reader Responsiveness. 659.131
W. D. Barrett. *Advertising and Selling Fortnightly*. August 13, 1924, v. 3, p. 48. How to determine the advertising value of periodicals.

Technique of the O Kay. 659.1
M. Lockenbrook. *Advertising and Selling Fortnightly*, August 13, 1924, v. 3, pp. 30, 55. Methods used by advertising agencies in presenting copy to their clients for a final O. K.

Where Is Your Strongest Competition? 659.1
F. J. Ross. *Printers' Ink*, July 10, 1924, v. 128, pp. 10, 12, 143. Advertising aims at the state of the consumer's mind which must be conquered and won over to the specific commodity the manufacturers sell.

Which Advertising Viewpoint—"Get-Rich-Quick" or "6 Per Cent and Safety". 659.1
Ray Giles. *Printers' Ink*, July 10, 1924, v. 128, pp. 3-4, 6. A strong appeal for honesty in advertising, giving many good examples of "half truths".

Building and Equipment

The Building Situation. 69
Special Report. No. 29. National Industrial Conference Board. New York. Pamphlet. 31 pp. A review of some of the more outstanding features of the building situation, purposing to present a general picture of conditions in this important branch of our economic life for the information of the public and the business community. The report is the result of an investigation conducted by the Conference Board's Research Staff.

Economic Factors in Industrial Plant Location. 658.21
P. F. Walker. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 259-264. National system of distribution, existing railroad conditions, transportation rates, markets, etc.

Good Lighting Equipment Pays. 658.242
J. J. McLaughlin. *American Machinist*, August 14, 1924. v. 61, pp. 253-256. Value of proper local lighting and supplementary overhead units. Discusses equipment and lamps.

How Belting Was Standardized in a Large Automotive Plant. 658.2621
H. A. Flogans. *Belting, Transmission, Tools and Supplies*. August 1924, v. 25, pp. 17-22. Illus. (To be continued).

Modernizing a Factory by Changing the Plant Layout. 658.2
Paul M. Atkins. *Industrial Power*, August 1924, v. 7, pp. 44-47, 76. Illus. A straight-line movement of materials, the use of gravity, and provision for future expansion were the improvements made.

Moving Factory to Reduce Manufacturing Costs. 658.21
R. F. Davidson. *Advertising and Selling Fortnightly*, August 13, 1924, v. 3, pp. 13-14, 44. Location of plant and its relation to sales; and the value of reducing transportation distance for raw materials.

Overcoming the Defects of the Loose Pulley. 658.2621
Hubert Bentley. *Canadian Machinery and Manufacturing News*, August 7, 1924, v. 32, pp. 37-48. Illus. How a reduction of the belt tension and an increase in bearing area eliminate overheating and excessive wear.

Safe Operation of Locomotive Crane. 658.283
C. T. Fish. *National Safety News*, August 1924, v. 10, pp. 8-10. Illus. Safety rules for crane operators. Suggests improvements possible in construction. Safety "education" most important.

Tentative Safety Code for Forging. 658.283
Forging — Stamping — Heat Treating, August 1924, v. 10, pp. 282-285. Formulated under the joint sponsorship of the National Safety Council and the American Drop Forging Institute.

Economics

Business Law. 347.7
Hugh W. Babb. Ronald Press Company, New York, 489 pp. $2. A textbook which will prove valuable to executives wishing to gain a more complete knowledge of business law or who desire information concerning the interpretation placed by the courts on questions similar to those with which they are confronted. The entire range of subjects in which business and law are related has been fully discussed. Some of these subjects are—contracts, sales, agency, negotiable instruments, partnerships, corporations, and insurance. The method of presentation is particularly helpful to easy understanding of so complex a subject as law. Each chapter contains first a simple statement of the law contained in that chapter. Then follows the text proper, written as simply and untechnically as is consistent with accuracy. Interspersed in the text and directly after it are numerous illustrative cases which indicate how the law has been interpreted by the courts.

Buying the Products of Labor. 331
A. J. Thompson. *Iron Trade Review*, August 21, 1924, v. 75, pp. 480-481. The products of labor must be subject to the fundamental laws of buying and selling. A monopoly of labor may be as disastrous to the nation's welfare as a monopoly of any commodity.

Charting the Business Seas. 338
Carl Snyder. *American Industries*, August 1924, v. 25, pp. 13-16. Charts. Emphasizes the usefulness of graphs and index charts in indicating the trend of business and industrial conditions.

Engineering in American Industry. 338(09)
Conrad Newton Lauer. McGraw-Hill Book Co., Inc. New York. 94 pp. $2.50. A review of the growth and development of manufacture in the United States and the contributions which engineering has made. Text matter consists of a lecture delivered at Princeton University. This has been supplemented by illustrations with descriptive footnotes portraying engineering progress and a large number of graphic charts. Altogether it makes a very interesting and instructive book on the subject of American industrial progress.

Future of the Machine Industry. 338
(Die Weltwirtschaftliche Zukunft der Maschinenindustrie), E. Schultze. *Machinenbau*, July 10, 1924, v. 68, pp. 703-707. International competitive efforts and the German machine industry.

Investigations Preliminary to Refinancing. 332:658
W. P. Lukens. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 271-275. The investigation made by the broker preliminary to the sale of a company's securities, includes a careful study of the company's history and organization record.

Mass Plans for Gaining New Savings Accounts. 332.2
B. W. Griffin. *American Bankers' Association Journal*, August 1924, v. 17, pp. 86-87. Illus. Advertising the bank by means of employees' contests; thrift week demonstrations in schools; and novelty distributions such as dime banks and printed pay envelopes.

The Measurement of Seasonal Variation. 338.97
Helen D. Falkner. *Journal of the American Statistical Association*, June 1924, v. 19, pp. 167-179. Charts, tables. The three known methods—the monthly means, the moving averages, and the median link-relative methods—discussed and evaluated. A fourth method suggested which makes allowance for the effects of other types of fluctuation without involving excessively laborious computations.

No Right to Maintenance. 331
Sir Ernest Benn. *The Gas World*, August 2, 1924, v. 81, p. 111. Attacks the socialists' claim to economic maintenance.

Post War Observations in Europe. 338
H. M. Lane. *Michigan Manufacturer and Financial Record*, August 9, 1924, v. 34, pp. 2, 26. Industrial, financial and employment problems confronting Germany, France and England, as seen by an American engineer.

Seasonal Operation in the Construction Industries. 331.137
McGraw-Hill Book Co., Inc. 213 pp. $2.50. A report of a committee of the President's Conference on Unemployment which was appointed by Secretary Hoover to determine how nearly it is possible to eliminate seasonal depressions in the activities of the construction industry. The Committee found that there is no reason except custom why construction should not proceed as rapidly in winter as in summer. Upon this basis they have built a strong argument for spreading construction work over the entire year instead of concentrating it in the period of warm weather.

Selecting a Bank. 332.1
G. A. O'Reilly. *Credit Monthly*, August 1924, v. 26, pp. 18, 30-31. Claims that most people select their bank because of some feature of "unusualness". Urges bankers to be mindful of this.

Southern Industrial Labor Supply. 38(75)
R. G. Macy. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 253-257. Illus. Labor conditions, wages and welfare in the textile industries of the Piedmont section of the Carolinas.

The Tax Problem in Wisconsin. 336.2
National Industrial Conference Board. New York. 163 pp. $2.50. A study of the tax problem in Wisconsin from the standpoint of industry. Although dealing mainly with the situation in that state—the study involves problems of extensive interest and national importance so that it has a much wider range of usefulness than the title indicates. The investigation reported was conducted by the Conference Board's Research Staff and was exhaustive in scope and authoritative in findings.

The Unemployment Problem. 331.137
E. D. Sebring. *Bulletin of the Taylor Society*, August 1924, v. 9, pp. 177-185. The economic viewpoint of unemployment; its relation to the business cycle, effect on social conditions; and various plans, national and international, of remedial measures.

Fuel

B T U Buying—For and Against. 662.55
V. G. Leach. *Steam Coal Buyer*, August 1924, v. 2, pp. 21-24. Coal of inferior analysis is often of greater efficiency than that showing higher B T U content.

Bark Driers and Refuse Burning. 662.991
G. D. Bearce. *Paper Trade Journal*, July 17, 1924, v. 79, pp. 39-40. Illus. Utilization of pulpwood bark for fuel. Describes refuse drying apparatus, designed in Sweden, using the waste chimney gases.

Coke as Fuel for Steam Raising. 662.6
E. W. L. Nicol. *The Gas World*, July 12, 1924, v. 81, pp. 35-36.

Combustion and Powdered Coal. 662.65
Charles Longenecker. *Pit and Quarry*. September 1924, v. 8, pp. 77-78. Principles of combustion and why pulverized coal has advantages over lump coal. Discusses furnace equipment and other factors of importance.

How to Improve as a Coal Buyer. 662.55
C. A. Snyder. *Steam Coal Buyer*, August 1924, v. 2, pp. 13-14. Fuel value of coal more important than the price.

Our Treatment of Coal, With Suggestions. 662.65
H. E. Armstrong. *The Gas World*, Supplement, July 12, 1924, v. 81, pp. 10-12.

Practical Coal Carbonization. 662.74
F. W. Sperr. *Universal Engineer*, August 1924, v. 40, pp. 31-37. High-temperature and low-temperature carbonization with special reference to American conditions.

Reciprocal Utilization of Waste Energy. 662.992
B. M. Gerbel. *Engineering* (London), July 11, 1924, v. 118, pp. 75-76. Possibilities of utilization of waste heat collected from widely separated plants.

30 Years of Co-operative Advertising. 662.76
Val Fischer. *Gas Age Record*, August 16, 1924. v. 54, pp. 233-234, 238. Describes the successful advertising work carried on by the British Commercial Gas Association during recent years.

Upward Trend in the Price of Our Oil. 662.75
Allen Addicks. *Gas Age Record*. August 9, 1924, v. 54, pp. 181-184. Oil production and consumption figures from the viewpoint of the gas engineer who sees in gas the solution of the fuel problem.

Industrial Methods

The Art of Public Speaking. 808.5
Albert J. Beveridge. Houghton Mifflin Co., New York. 67 pp. $1. A concise and practical volume on the principles of public speaking by a well-known American orator and writer. In such a small compass no great amount of detail information could be given but the person interested in improving his public utterances will find, in this book, many valuable suggestions.

Automatic Combustion Control. 621.182
C. H. Smoot. *Textile World*, August 2, 1924, v. 66, pp. 85, 87, 89. Efficiency in boiler control other than that effected by mechanical stokers. Flue tests, ratio of fuel to air, etc.

Auxiliary Equipment for Blast and Ventilating Fans. 621.53
C. L. Hubbard. *Mechanical World* (England), August 1, 1924, v. 76, p. 70. Illus.

Brakes Used to Retard or Hold Rotating Parts. 621.8384
A. J. Whitcomb. *Industrial Engineer*, July 1924, v. 82, pp. 317-320, 328. Illus. Application to cranes, hoists, elevators, turntables, and the like to prevent overtravel, hold loads, and make emergency stops.

Can Anybody Do These Things Cheaply? 608
E. E. Free. *Universal Engineer*, August 1924, v. 40, pp. 68, 70, 72. A challenge to inventors—how to make cheap aluminum; how to store power; make flexible glass; rustless iron; etc.

A Code of Ethics That Meets Daily Problems of Business. 174
Ralph Crothers. *Printers' Ink*, July 10, 1924, v. 128, pp. 155-156, 158. The Electrical Power Club of Cleveland offers suggestion to all industries to establish inter-business standards of conduct.

Comparison of Pumping Equipment. 621.64
R. T. Livingston. *Power Plant Engineering*. August 15, 1924, v. 28, pp. 849-850. Tables. Suggests a practical method of comparison.

The Deterioration and Preservative Treatment of Timber. 691.15
A. S. Dawson. *The Engineering Journal*, August 1924, v. 7, pp. 558-563. Table. Diagr. The application of zinc chloride, sodium fluoride, copper sulphate, mercuric chloride, and creosotes to offset the destructive action of fungi, economically and comparatively considered.

Dumping Devices for Lignite Working. 622.331
(Kippenmechanisierung in Braunkohlen-Tagebaubetrieben), Fr. Bennecke. *Zeitschrift des Vereines Deutscher Ingenieure*, August 9, 1924, v. 68, pp. 817-820. Description of operation procedure, transportation and machines used.

Electrical Engineering as a Factor in the Development of Modern Steelworks. 669.1
W. Geyer. *Iron and Coal Trade Review*, July 25, 1924, v. 109, p. 153-154. Describes types of machines used in Great Britain and Germany.

Grinding Operations Expedite Manufacture of Machinery Tools. 621.92
W. E. Groene. *Abrasive Industry*, August 1924, v. 5, pp. 189-192. Illus. Grinding tools and tool-room equipment and operation procedure in use at the Le Blond Machine Tool Co.

How the Airplane Can Be Used in Industry. 629.13
S. M. Felton. *Central Manufacturing District Magazine*. August-September, 1924, v. 8, pp. 4-5, 7.

How the United States Can Meet Its Present and Future Pulp Wood Requirements. 676
Department of Agriculture, Washington, D. C. 100 pp. 15 cents. Pamphlet. A study, of interest to pulp and paper manufacturers, of the future pulp wood requirements and sources of supply. It is a report of an investigation conducted by the Forest Service to supply information on these subjects: 1. Present pulp wood and paper requirements and the character and extent of our imports; 2. Probable future requirements; 3. Should this country become self-supporting in its pulp wood requirements; 4. Existing timber resources; 5. How this country can grow sufficient pulp wood to meet future requirements; 6. Supplementary measures essential to solution of both present and future problems.

How the United States Can Meet Its Present and Future Pulp Wood Requirements. 676
E. H. Clapp and C. W. Boyce. *Paper Trade Journal*, August 7, 1924, v. 79, pp. 47-50. Diagrs. By growing more pulp wood, improving protection against fire, conducting forest products investigations and researches, and applying the results of research as rapidly as they become available.

Is Industrial Gas Business Prohibitive Because the Rates are Too High? 665.7
A. B. Greenleaf. *American Gas Journal,* August 9, 1924, v. 121, pp. 721-724. Illus. "Too high rates" a fallacy—industrial load would reduce rates.

Muscle Shoals—Industry Touchstone. 62(761)
John W. Hammond. *American Industries,* August 1924, v. 25, pp. 19-23. Illus. A description and history of its development, with a consideration of its potential industrial possibilities.

Preparation of Iron and Steel Surfaces for Paint. 667.6
Railway Review, August 2, 1924, v. 75, pp. 166-173. Resumé of tests conducted by the A. S. T. M.

Profit in Reclaiming the Wastes of Heating and Ventilating. 621.101
F. X. McGovern. *Industrial Power,* August 1924, v. 7, pp. 33-37, 80. Illus. Economy to be derived by an avoidance of high temperatures and of excessive infiltration of cold air.

Progress in Metal Work. 621.92
(Fortschritte der Metallbearbeitungstechnik). Buxbaum. *Zeitschrift des Vereines Deutscher Ingenieure,* August 2, 1924, v. 68, pp. 798-802. Grinding and polishing in machine shop practice. Describes and illustrates machines used.

Some Phases of Government in Business. 174
Herbert Hoover. *Paper Trade Journal,* August 7, 1924, v. 79, pp. 57-60. Suggests that the business world develop and enforce its own ethical standards and thus stem the tide of governmental regulation.

Inspection

A Few High Points on the Inspection of Processed Material. 658.562
C. S. Stark. *Society of Automotive Engineers Journal,* August 1924, v. 15, pp. 156-158. Detail and general inspection of parts of automobile plants. Discusses the use of go and no-go gages and taps calibrated by three-wire standard.

Influence of Numerous Handlings on Inspection Cost. 658.562
A. H. Frauenthal. *Society of Automotive Engineers Journal,* Aug. 1924, v. 15, pp. 158-160. Illus. Diagrs. A comparative time-study of the multiple gaging, flush-pin gaging, and camshaft-gear methods of inspection of automobile parts.

Maintaining High Quality Production. 658.562
C. J. Jones. *Society of Automotive Engineers Journal,* August 1924, v. 15, pp. 160-162. Inspection work in an automobile plant depends upon co-operation between the engineering and the production departments.

Measurement of the Quality of Product. 658.562
G. S. Radford. *Mechanical Engineering,* September 1924, v. 46, pp. 546-547. Standards by means of which quality may be judged.

Maintenance and Repair

Inspection Routine and Methods of Controlling Industrial Lubrication. 658.581
K. Richards. *Industrial Engineer,* August 1924, v. 82, pp. 368-372. Illus. Centralized control of machine equipment in widely separated factories. Lubrication problems in machines of cake factory.

Insulating Varnish Tests That Are Easy to Make. 658.581
H. L. Hazeltine. *Industrial Engineer,* August 1924, v. 82, pp. 381-385, 402. Varnishes, their solvents and the equipment for their application.

Managing Maintenance Work With Economy. 658.58
T. Clark. Management and Administration, Sept. 1924, v. 8, pp. 299-302. Methods of taking time studies and paying bonuses.

Management—Financial Control

Elements of a Financial Investigation. 658.14
R. G. Davis. Management and Administration, Sept. 1924, v. 8, pp. 277-278. Conditions that call for financing or refinancing of a business and a practical outline of a financial investigation.

Financial Organization and Management. 658.14
Charles W. Gerstenberg. Prentice Hall, Inc. New York. 723 pp. $5. Although intended primarily for use as a textbook in corporation finance, business men interested in the subject will find much material in this book of value to them in their work. Every phase of business from promotion to failure and reorganization is discussed in detail. The financial problems arising throughout the life of a business concern are described and, with frequent use of historical examples, methods used for solving them given. A number of charts and forms are used to illustrate the text, which add to the practical value of the book. Footnotes are used extensively to give sources where the reader may find further information on the particular subject being discussed. In spite of the technical nature of the subject, the book is written in a very interesting and readable manner.

Investigations Preliminary to Refinancing. 658.14
W. P. Lukens. Management and Administration, Sept. 1924, v. 8, pp. 271-275. The investigation made by the broker preliminary to the sale of a company's securities, includes a careful study of the company's history and organization record.

Management of Special Industries

Bark Driers and Refuse Burning. 658.9:676
G. D. Bearce. *Paper Trade Journal,* July 17, 1924, v. 79, pp. 39-40. Illus. Utilization of pulpwood bark for fuel. Describes refuse drying apparatus, designed in Sweden, using the waste chimney gases.

Establishing Material and Parts Control. 658.9:629.113
G. D. Babcock. Management and Administration, Sept. 1924, v. 8, pp. 265-270. Illus. Building tractors under scientific management at the Holt plant. Manufacturing program of parts is scheduled on the basis of the dates on which tractor is to be delivered by the shop. Detailed description of system and records used is given.

Factors That Determine the Details of Paper-Mill Drives and Power Service. 658.9:676
H. E. Stafford. *Industrial Engineer,* August 1924, v. 82, pp. 360-367. Illus. Transformation and distribution of electric power, types of motors and kinds of drive used to connect the motors to their loads. Characteristics of paper-mill loads.

Finding Actual Cost of Castings. 658.9:621.72
G. C. Cocker. *Iron Trade Review,* August 14, 1924, v. 75, pp. 421-422. System for determining selling price should consider time required to produce castings and amount of metal needed to pour them.

Forecasting Demand for Industrial Equipment. 658.9:621.9
Ernest F. Du Brul. *Mechanical Engineering,* September 1924, v. 46, pp. 539-542. Charts. The need for a co-operative study of the economic problem of stabilizing employment and production, with a consideration of the business cycle in the machine-tool industry.

Lumber Handling in an Automobile Body Plant. 658.9:674
B. Nagelvoort and Thomas D. Perry. *The Automotive Manufacturer,* July 1924, v. 66, pp. 7-9, 26. Illus. Tables. Diagrs. Handling, storing, drying and cutting of lumber. The use of dry-kiln storage on wheels, dry-kiln trucks and transfer cars.

Management in the Clothing Industry. 658.9:687
S. E. Thompson and W. E. Freeland. Management and Administration, Sept. 1924, v. 8, pp. 289-294. Charts. How market analysis and standardization of production developed stability.

Material Handling as Our Key to Many Savings. 658.9:629.113
M. R. Denison. *Factory,* August 1924, v. 33, pp. 190-193, 242. Illus. Routing trucks and tractors on a train schedule basis including transportation in all departments. Types of conveyors and system described in detail.

Material Handling Problems in Automobile Assembly. 658.9:629.113
M. R. Denison. *The Automotive Manufacturer,* July 1924, v. 66, pp. 10-12. (Continued from June issue). Conveyors used at the Studebaker plants.

Mechanical Handling at River Rouge. 658.9:629.113
M. W. Potts. *Industrial Management*, August 1924, v. 68, pp. 67-114. Illus., Diagrs. Description of the Ford plant at River Rouge. Emphasizes the handling of materials and the co-ordination of departments, and operations and by-product industries on the basis of economic operation. Includes a view of the plant with a list of the types of materials handling equipment employed.

Putting the Drafting Room on a Production Basis. 658.9:621.75
W. E. Irish. *Industrial Management*, August 1924, v. 68, pp. 121-126. Illus. Applying in the drafting room the known principles of first gathering the facts, next giving them logical arrangement, and finally, controlling their development with authority and responsibility.

Routing and Handling Material in Making a Quarter-Horsepower Motor. 658.9:621.3
L. C. Morrow. *American Machinist*, August 21, 1924, v. 61, pp. 291-294, pt. 1. Illus. Detailed description and diagrams illustrating straight line method of manufacture of small motors. Shows how materials are handled, use of belt conveyors, etc.

Saving Device in the Planning Department. 658.9:621.75
(Kostenersparnis im Konstruktionsbüro), L. Vogt. *Maschinenbau*, July 10, 1924, v. 68, pp. 698-699. Illus. Describes drawing machines for drafting-room use.

Selling Products of Steel Foundries. 658.9:621.72
W. J. Corbett. *Iron Trade Review*, August 14, 1924, v. 75, pp. 415, 422. Steel castings should not be sold by weight. Each pattern should have a definite price based on the cost of production.

Significant Savings in Textile Mill Operations. 658.9:677
N. T. Thomas. *Bulletin of the Taylor Society*, August 1924, v. 9, pp. 172-176. Valuable results obtained from the substitution of scientific management for tradition in southern cotton mills.

Steam Distribution, Pumping Extravagance and Practical Suggestions for Improvement. 658.9:676
F. C. Farnsworth. *Paper Trade Journal*, July 24, 1924, v. 79, pp. 43-47. Applies to drying systems in paper mills.

Material Control

Establishing Material and Parts Control. 658.78
G. D. Babcock. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 265-270. Illus. Building tractors under scientific management at the Holt plant. Manufacturing program of parts is scheduled on the basis of the dates on which tractor is to be delivered by the shop. Detailed description of system and records used.

How Our Perpetual Inventory Saves Us the Expense of Guessing. 658.787
Wm. P. Mackey. *Factory*, August 1924, v. 33, pp. 199-201, 292. Illus. Gives outline of inventory system. Main aim is to report at all times amount and value of everything in and about the plant.

Management Difficulties in Small Factories and Their Solution. 658.78
H. W. Ross. *Cassiers Industrial Management*, August 1924, v. 11, pp. 377-378. Material control with the buyer in control of the storeskeeper. Outlines duties of buyer, records to be kept, and relation with sales department.

Material Control in Machine Shop With Specific Reference to Cost Accounting. 658.78
(Materialverwaltung in Maschinenfabriken unter entsprechender berücksichtigung der Selbstkostenerfassung), *Machinenbau*, July 24, 1924, v. 68, pp. 753-755.

Methods of Packing for Export. 658.7884
C. J. Priebe. *American Machinist*, August 7, 1924, v. 61, pp. 237-240. Illus. Standard specifications for export boxing; a system thoroughly tested by the Worthington Pump and Machinery Corporation.

Store Delivery of Material to Users at Shops. 658.78
J. E. Perry. *Railway Review*, August 2, 1924, v. 75, pp. 155-160. Stores delivery system organized by the Southern Pacific Railroad resulted in substantial savings.

Systematic Grouping of Machine Parts. 658.782
(Die Systematische Gruppierung in Werkstückaufbau), Hoffman. *Maschinenbau*, July 10, 1924, v. 68, pp. 693-698. Minute description and diagram of plan.

Mechanical Handling

Continuous Conveyor Systems for Mass Transportation. 658.281
(Neuzeitlicher Massentransport mit Dauerförderern). Buhle. *Zeitschrift des Vereines Deutscher Ingenieure*, July 26, 1924, v. 68, pp. 777-781. Illus. Describes various coal conveyors.

Conveying System at Winnsboro Mills. 658.281
C. M. Mumford. *Textile World*, August 2, 1924, v. 66, pp. 73, 75, 77. Illus. A system connecting two mill units carrying operations from beginning to completion. Automatic features are described and various spiral chutes, gravity, belts, boosters, and inclines.

Machines Reduce Man Power in Warehouses. 658.281
C. F. Paul. *Central Manufacturing District Magazine*. August-September, 1924, v. 8, pp. 23, 25, 27. Industrial trucks and tiering elevators used in cold storage plants.

Material Handling as Our Key to Many Savings. 658.281
M. R. Denison. *Factory*, August 1924, v. 33, pp. 190-193, 242. Illus. Routing trucks and tractors on a train schedule basis including transportation in all departments. Types of conveyors and system described in detail.

Measuring the Efficiency of Shop Trucks. 658.281
S. M. Lowry. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 279-284. Charts. Methods used at the Westinghouse plant.

Mechanical Handling at River Rouge. 658.281
M. W. Potts. *Industrial Management*, August 1924, v. 68, pp. 67-114. Illus., Diagrs. Description of the Ford plant at River Rouge. Emphasizes the handling of materials and the co-ordination of departments, and operations and by-product industries on the basis of economic operation. Includes a view of the plant with a list of the types of materials handling equipment employed.

Monorail Conveyors in the Factory. 658.281
(Chemins de Fer Monorails D'Usine). *Génie Civil*, July 5, 1924, v. 85, pp. 16-18. Illus.

Types of Cranes for the Power Plant. 621.87
Power Plant Engineering, August 15, 1924, v. 28, pp. 846-848. Illus. Diagr.

Office and Equipment

Drawing Index. 651.5
(Zeichnungskartei). C. Eckers. *Maschinenbau*, July 10, 1924, v. 68, pp. 692-693. Filing and index records for machine design drawings.

Mechanical Aids in Accounting. 651.26
F. A. Brine. *American Gas Journal*, August 9, 1924, v. 121, pp. 738-741. Mechanical devices which save time.

Principles of Business Writing. 651.7
T. H. Bailey Whipple. Westinghouse Technical Night School Press, East Pittsburgh, Pa. 182 pp. $2. A valuable addition to the constantly growing library on the subject of business writing is found in this book prepared by the literary critic of Westinghouse Electric and Manufacturing Company. It contains material originally prepared for a company publication which has been revised and extended to its present form. Principles of business letter writing are first discussed after which there appears a very extensive list of words and phrases often misused. A section on report writing is followed by a section which considers the mechanics of letter writing. In appendices are given some suggestions to authors and a list of questions and answers pertaining to business writing.

Should There Be a Master-Censor of Letters? 651.457
W. H. Heath. *Printers' Ink*, August 14, 1924, v. 128, pp. 53-54, 56. What an executive found when going over a day's mail. Out of 200 letters 50 envelopes came under the ban.

Personnel

Accidents and Workmen Responsibility. 658.382301
(Unfallhaüfigkeit und persönliche Eigenschaften). K. A. Tramm. *Werkstattstechnik*, August 1, 1924, v. 18, pp. 395-398. Charts. Charts and statistics the result of an investigation concerning the cause of accidents and means of prevention.

Competing Plants in Safety Contest. 658.3823
G. A. Brayton. *Iron Trade Review*, August 21, 1924, v. 75, pp. 482-483. Schemes used to develop interest in accident prevention campaigns.

Danger of Too Much Talk About Cooperation. 658.315
Hayes Robbins. *Railway Age*, August 9, 1924, v. 77, pp. 235-236. Practicing cooperation, not talking it, is present need. Lax discipline or sentiment not necessary.

Employee Specifications. 658.3115
P. M. Atkins. *Industrial Management*, August 1924, v. 68, pp. 115-118. Suggests preparing standards of qualifications for employees and the recording of them in the form of specifications.

Employment Terminology. 658.3(03)
Fred Telford. *Public Personnel Studies*, August 1924, v. 2, pp. 152-166. Difficulties encountered by personnel administrators due to the lack of a common understanding of employment terminology. A great many words in present use are discussed and defined.

Essentials of First Aid Work. 658.382271
Dr. H. W. Gentles. *National Safety News*, August 1924, v. 10, pp. 5-7. Illus. Some do's and don'ts with advice about first aid instructions in plants.

An Evaluation of Some Information Questions. 658.31156
William R. Wilson and others. *Journal of Applied Psychology*, June 1924, v. 8, pp. 206-214. Tables. Method of measuring the value of questions included in intelligence tests, giving also a sample list of good questions and poor ones.

The "Eyes" of the Motor Industry. 658.3822
Michigan Manufacturer and Financial Record, August 9, 1924, v. 34, p. 3. Eyesight tests for employees at the Buick and Ford motor companies indicate that a very large per cent have defective vision.

How a Spun Silk Plant Fits Men to Its Jobs. 658.3
D. G. Woolf. *Textile World*, August 9, 1924, v. 66, pp. 21-23. Illus. Within the plant relations based on voluntary cooperation between employment department and personnel. Describes plan of hiring, discharging, and checking workers.

Industrial Executive. 658.31242
B. A. Franklin. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 249-252. The modern executive's qualifications and his place in the industrial system.

Industrial Psychology. 15
H. S. Person. *Bulletin of the Taylor Society*, August 1924, v. 9, pp. 163-171. Psychology and its relation to management and personnel problems; also the value this application of the science may have on its further development, especially as "adult psychology".

Labor Law Factors and Theft Control. 658.313
(Arbeitsrechtliche Momente der Diebstahlsbekämpfung), Franz Goerrig. *Werkstattstechnik*, August 1, 1924, v. 18, pp. 400-403. Shall workmen caught in theft be peremptorily dismissed and to what extent may employers combine to keep these men from getting other employment through the publication of such information.

Morale as an Industrial Asset. 658.314
R. F. Foster. *American Industries*, August 1924, v. 25, pp. 33-34. How the Todd Protectograph Company maintains the high morale of its employees and secures greater productivity and efficiency as a result.

The Observing Employee. 658.31472
Personal Leaflets—no. 3. Metropolitan Life Insurance Co. 12 pp. How suggestion boxes may be made a success with a report on successful schemes now in use.

Southern Industrial Labor Supply. 658.38
R. G. Macy. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 253-257. Illus. Labor conditions, wages, and welfare in the textile industries of the Piedmont section of the Carolinas.

Taking Care of the Employee. 658.38
J. W. Wiley. *Central Manufacturing District Magazine*. August-September, 1924, v. 8, pp. 77-79, 81. Workers' health an investment worth watching. Opinions of industrial leaders are quoted.

Validity of Character Judgments Based on External Criteria. 658.31156
Glen U. Cleeton and F. B. Knight. *Journal of Applied Psychology*, June 1924, v. 8, pp. 215-231. Tables. The statistical results of a series of tests indicating that the physical external factors are not to be relied upon in measuring traits of character.

What We Think of Industrial Democracy After 7 Years. 658.3151
William P. Hapgood. *Factory*, August 1924, v. 33, pp. 187-189, 286. Illus. The successful experience of a factory council in establishing personnel control, deciding on hours and wages and increasing plant efficiency and output.

Power and Power Plants

Commercial Efficiency in Transformation and Distribution of Energy. 658.26
Charles E. Luecke. *National Engineer*, August 1924, v. 28, pp. 367-370. Tables. Diagrs. (To be continued). The different methods considered from the viewpoint of cost and efficiency.

Evaporative Capacity of Boilers. 621.18
A. A. Arnold. *Mechanical World* (England), August 1, 1924, v. 76, pp. 69-70.

Factors That Determine the Details of Paper-Mill Drives and Power Service. 658.26
H. E. Strafford. *Industrial Engineer*, August 1924, v. 82, pp. 360-367. Illus. Transformation and distribution of electric power types of motors and kinds of drive used to connect the motors to their loads. Characteristics of paper-mill loads.

Firing a Hand-fired Down Draft Furnace. 621.182
J. F. Barkley. *Steam Coal Buyer*, August 1924, v. 2, pp. 18-20. Results of firing tests on two types of grates and recommendations as to proper method of firing.

The First World Power Conference. 62(063)
Hugh Quigley. *World Power*, August 1924, v. 2, pp. 78-83. A general commentary on the subjects of the conference giving special attention to the power resources of countries like Hungary, Poland, etc.

Fundamentals of Hydraulic Power Development. 621.2
J. C. Taylor. *National Engineer*, August 1924, v. 28, pp. 365-366. Table. The need for reserve steam plants to carry loads at periods of low water. Gives statement of the potential water power in the United States.

Proceedings of the First World Power Conference. 62(063)
Engineer (London), July 4, 1924, v. 118, pp. 35-47; July 11, 1924, v. 118, pp. 35-49. Reports covering the power production sections of the Conference with brief resumés of papers read.

Small Size Boiler Economy Increased by Stokers. 621.18414
Robert June. *Gas Age Record*, July 26, 1924, v. 54, pp. 113-115. Illus. Mechanical stokers save 40 per cent fuel in small plant.

Some Reasons Why Isolated Power Plants Are Shut Down. 658.26
A. W. Lewis. *National Engineer*, August 1924, v. 28, pp. 379-381.

Steam Accumulation. 621.18
J. Ruths. *Engineering* (London), July 11, 1924, v. 118, pp. 68-69. Illus. Advocates method of storing steam in water under increasing pressure and discharging it under falling pressure.

Steam Turbines for High Pressure. 621.165
C. F. Stork. *Engineering* (London), July 11, 1924, v. 118, pp. 69-70. Difficulties concerning the design of disc turbines. Discusses a new high pressure turbine built by the Brünner Maschinenfabrik.

Production Control

Application of Micrometers in Railway Shops. 658.56
M. H. Williams. *Railway Mechanical Engineer*, August 1924, v. 98, pp. 481-485. Illus.

Application of Motion Study. 658.5423
F. B. and L. M. Gilbreth. MANAGEMENT AND ADMINISTRATION, Sept. 1924,

v. 8, pp. 295-297. Charts. More explanations of the 17 therbligs and their relation to stop-watch time study, fatigue study, standardization, etc.

Applying the Gantt Chart in France. 658.53
Serge Héranger. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 305-309. Charts. Progress and layout charts in automobile and rifle manufacture.

Burlington Dismantles Cars at Eola Scrap Dock. 658.5671
Railway Mechanical Engineer, August 1924, v. 98, pp. 477-479. Illus. The scrapping process which three hundred steel cars of the Chicago, Burlington and Quincy Railroad underwent at the Eola reclamation plant. Gives figures of the cost and derived profit for the railroad.

Controlling the Labor. 658.5:657
National Association of Cost Accountants. *Official Publications*, August 15, 1924, v. 5, no. 23. Direct and indirect labor, records for employment and pay-roll departments, distribution of labor expenditures, and necessary labor reports for the purpose of measuring performance. Subject is discussed by W. O. Cutter, C. A. Williams and D. W. Hook.

Directions for the Introduction of Time Study. 658.5421
(Richtlinien für die Einführung des Zeitakkordes). *Maschinenbau*, July 10, 1924, v. 68, pp. 719-721.

Graphic Statistics in Management. 658.53
William H. Smith. McGraw-Hill Book Co., Inc. New York. 360 pp. $4. A treatment of the principles of statistical and graphical practice which aims to coordinate the two subjects in a way that will be of practical value to the reader. In the early part of the book the entire problem of constructing graphs is discussed. This includes determination of what information is to be shown, how it is to be obtained, its proper arrangement for graphical presentation, the choice of graph type to be used, and its actual construction. The last part of the book deals with the application of graphics to specific business purposes. Subjects discussed include organization and executive charts, purchasing, production control, market analysis, sales, advertising, finance, accounting and costs.

Importance of the Cost of Idleness in Equipment Industries. 658.5:657
E. F. Du Brul. National Association of Cost Accountants. *Official Publications*, August 1, 1924, v. 5, no. 22. Management difficulties in obtaining and applying cost analysis so as to prevent violent fluctuations.

Managing Maintenance Work With Economy. 658.5
T. Clark. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 299-302. Methods of taking time studies and paying bonuses.

Our Nine Gains from "Planned Production". 658.5
George A. Meihaus. *Factory*, August 1924, v. 33, pp. 206-207, 296. Illus. Production planning and control for the entire plant including continuous inventory. Reorganization described in detail.

A Practical System of Tool Storage and Control. 658.563
F. A. Pope. *Factory*, August 1924, v. 33, pp. 208-211. Illus. Definite suggestions for centralized storage including flexible shelves, mechanical handling equipment, and grouping of tools.

Precalculations and Planning. 658.5
(Das Problem der Vorkalkulation und seine Lösung). K. Hegner. *Zeitschrift des Vereines Deutscher Ingenieure*, August 9, 1924, v. 68, pp. 821-824. Time study and planning applied to the whole production organization.

Production Organization. 658.56
N. Gerard-Smith. *Mechanical World* (England), July 18, 1924, v. 76, pp. 36-37. Third article in a series on shop reorganization. Discusses principles underlying successful production.

The Purpose of a Planning Department in Industrial Undertakings. 658.5
(Aufgaben und Bedeutung des Konstruktions Büros in Industrie Unternehmungen). H. Menge. *Maschinenbau*, July 10, 1924, pp. 679-693. Describes a central planning department, emphasizing its duty to establish and maintain standards for every phase of the work. Discusses equipment, records, and systems for filing designs, etc.

Routing and Handling Material in Making a Quarter-Horsepower Motor. 658.512
L. C. Morrow. *American Machinist*, August 21, 1924, v. 61, pp. 291-294, pt. 1. Illus. Detailed description and diagrams illustrating straight line methods of manufacture of small motors. Shows how materials are handled, use of belt conveyors, etc.

Tool-Room Management. 658.563
(Die Verwaltung des Werkzeuges in der Maschinenfabrik). A. Messerschmidt. *Werkstattstechnik*. August 1, 1924, v. 18, pp. 398-400. Control—distribution—maintenance of tools.

A Well-Planned Tool System. 658.563
Engineering Production. August 1924, v. 7, pp. 229-232. (To be continued). Comprehensive plan for tool department covering control from purchase to replacement. Numerous record cards are given.

Research and Standardization

Can Bond Papers Be Standardized? 676(003)
William B. Wheelwright. *Paper Trade Journal*, July 3, 1924, v. 79, pp. 38, 40.

Design Elements for Instruments. 62(003)
(Konstruktionselemente der Feinmechanischen Technik). O. Richter. *Maschinenbau*, July 24, 1924, v. 68, p. 723. Illus. Standardization of instruments, parts, and measuring tools.

Laboratory Strength-Tests of Motor-Truck Wheels. 629.113(072)
T. W. Greene. *Society of Automotive Engineers Journal*. v. 15. August 1924. pp. 150-155, 174. Illus., charts. Results obtained from the radial-compression and side-thrust or skid tests.

Modern Methods of Truck Testing. 629.113(072)
W. L. Day. MANAGEMENT AND ADMINISTRATION, Sept. 1924, v. 8, pp. 285-287. Illus. Performance tests for motor trucks.

The Problem of a Standard Index Number Formula. 651.4655
George R. Davis. *Journal of the American Statistical Association*. June 1924, v. 19, pp. 180-188. Tables. The present index formulae reviewed and a new one proposed, discussed, and illustrated.

Research Work in Industry. 6(072)
J. G. Pearce. *Iron and Coal Trade Review*, August 1, 1924, v. 109, pp. 202-203. Makes special reference to the British cast iron research association.

Standardization Versus Individuality. 658.516
Luther D. Burlingame. *Mechanical Engineering*, September 1924, v. 46, pp. 529-30, 538. The dangers of overstandardization and the need for guarding against the abandonment of basic standards and established principles until the benefits of a change are evident.

"You Couldn't Tempt Us to Build Two Sizes or Styles". 658.516
Wm. H. Newbrough. *Factory*, August 1924, v. 33, pp. 194-196, 278. Illus. Simplification found beneficial; 28 styles reduced to one, resulted in better engines, production economy, reduction of materials, etc.

Selling and Purchasing

Advertising and the Evil of Unjust Cancellation Orders. 658.857
E. P. Cochrane. *American Bankers' Association Journal*, August 1924, v. 17, pp. 26, 28, 54. Public opinion and mass action necessary to eliminate the practice all along the line.

Are Salesmen Doing Too Much Selling? 658.83
Maxwell Droke. *Sales Management*, August 1924, v. 7, 1378, 1380, 1382. To sell the right quantity and gain customers' confidence a better policy than overloading.

Can American Selling Methods Be Used in Foreign Markets? 658.82
H. B. Blauvelt. *Printers' Ink Monthly*, August 1924, v. 9, pp. 27-28, 121. Adapting American methods to meet foreign prejudices; makes valuable suggestions with special reference to English markets.

Fitting the Sales Plan to Present Day Buying Tendencies. 658.83
J. B. Wright. *Sales Management,* August 1924, v. 7, pp. 1340, 1420. Applies assortment plan of selling to speed turnover of dealers' stock.

Hidden Factors in the Sale. 658.83
Roy Dickinson. *Printers' Ink,* August 21, 1924, v. 128, pp. 3-4, 6. Why analysis of all influences affecting final sales are necessary.

How Can We Get the Dealer to Do Things Our Way? 658.83
G. A. Nichols. *Printers' Ink,* August 21, 1924, v. 128, pp. 17-20. Attractive schemes used by Ralston Purina Company to advertise their goods and increase dealers' sales.

How Many Secrets Should a Salesman Divulge About His "Last Place". 658.8:174
W. H. Heath. *Printers' Ink,* August 7, 1924, v. 128, pp. 41-42, 44. Salesmanship ethics requires loyalty to the "house" he has left.

How Shall We Pay Salesmen to Get Them to Work Harder? 658.81
G. A. Nichols. *Printers' Ink Monthly,* August 1924, v. 9, pp. 19-20, 102. What leading manufacturers have found out in wrestling with this question.

How to Keep Salaried Salesmen Steadily on the Job. 658.846
G. A. Nichols. *Printers' Ink,* July 24, 1924, v. 128, pp. 25-26, 28. How the Coleman Lamp Company changed its paying basis for on-the-road salesman so as to minimize waste of time and establish good service.

How to Make 'Em Like the Straight Commission Plan. 658.8462
C. C. Casey. *Printers' Ink,* August 14, 1924, v. 128, pp. 3-4, 6.

How We Made Our Money Go Twice as Far in Financing Sales. 658.808
G. R. Meyercord. *Sales Management,* August 1924, v. 7, pp. 1337-1338, 1436. Greater advertising pressure to speed sales during dull seasons succeeded in leveling seasonal peaks and depressions.

How Will You Hold the Ambitious Salesman? 658.81
C. G. Muller. *Printers' Ink Monthly,* August 1924, v. 9, pp. 37-38, 122. How sales managers have met this problem.

Importance of Research in Industrial Advertising. 658.83
A. M. Staehle. *Advertising and Selling Fortnightly,* August 13, 1924, v. 3, pp. 17, 64. Sources of information that will aid in determining the selling market for a commodity. Questionnaire has its meritorious points.

The Jobber Finds a Real Friend. 658.86
R. M. Trangmar. *Michigan Manufacturer and Financial Record,* August 2, 1924, v. 34, p. 5. The organization of the Automotive Equipment Association for the purpose of promoting the professional jobbing houses through which materials are handled after leaving the factory.

Little Touches That Make Sales Manuals More Effective. 658.826
E. B. Weiss. *Printers' Ink,* August 7, 1924, v. 128, pp. 158, 161-162, 164.

Manuals That Teach Retailers How to Get More Business. 658.826
E. B. Weiss. *Printers' Ink,* August 14, 1924, v. 128, pp. 41-42, 44.

Marketing the Technical Product. 658.845
E. N. Simons. *Mechanical World* (England), July 25, 1924, v. 76, pp. 53-54. (To be continued). Value of exhibitions —how to select the firm representative, what style of copy to use, and follow-up work.

Offer of Too Much "Service" May Prove a Boomerang. 658.8
J. R. Sprague. *Printers' Ink,* August 21, 1924, v. 128, pp. 110, 112-113. Urges a sound foundation for business. Giving "service" more worthwhile than talking it. Warns against linking business to "movements".

The Only Real Basis for Successful Sales Promotion. 658.82
James True. *Printers' Ink,* July 31, 1924, v. 128, pp. 33-34, 36. Research of economic conditions necessary to determine the basis for distribution.

Organizing the Factory to Promote Sales. 658.8
W. J. Hiscox. *Mechanical World* (England), v. 76, pp. 73-74. Other factors than salesmanship necessary to promote sales are price, quality of product and prompt delivery.

Purchasing Power Plant Equipment. 658.7
Power Plant Engineering, August 1, 1924, v. 28, pp. 795-796. Necessary co-operation between engineer and buyer. Discusses specifications, tabulation of bids and catalogs.

The Sale That Begets a Sale. 658.85
E. M. Wickes. *Printers' Ink,* July 10, 1924, v. 128, pp. 91-92, 95. Satisfying the customer the safest sales policy. Advises against overloading.

The Salesman Is Right if the Selling Methods Are Right. 658.85
R. N. King. *Printers' Ink Monthly,* August 1924, v. 9, pp. 31-32. Old versus new selling methods.

Selecting the Tryout Market. 658.808
F. D. Webb. *Printers' Ink,* August 21, 1924, v. 128, pp. 25-26, 28. What a trial campaign will demonstrate and how to find an average market for the test.

Teaching the Retailer How to Sell the Goods. 658.85
Joseph Ewing. *Advertising and Selling Fortnightly,* August 13, 1924, v. 3, pp. 15-16, 60.

This Is Not the Salesmanager's Job. 658.811
H. G. Willnus. *Printers' Ink,* July 24, 1924, v. 128, pp. 89-90. Reasons why a salesmanager should not have charge of collection accounts.

What Should Go Into the Good Will Booklet 658.826
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CONDITIONS AND PROSPECTS
IN
BUSINESS AND INDUSTRY

Recovery Continues: Future Uncertain

Prepared by LEWIS H. HANEY

Director, New York University Bureau of Business Research[1]

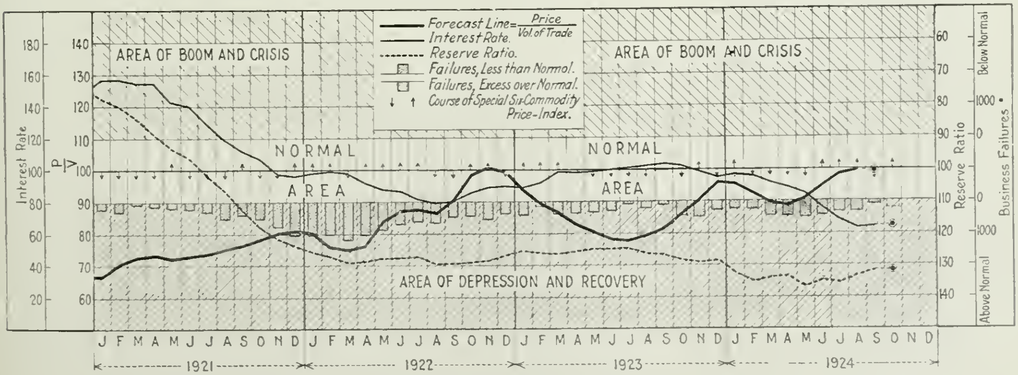
In September upward trend of the P/V line, as shown in Fig. 1, came to a halt. This line is the main forecasting line of general business conditions, and its present trend shows the probable status of business four to six months hence. The three months' moving average shown in the graph continued upward, though at a decreased rate; but the data for the single month of September indicated a slight fractional setback. This is just sufficient to justify the impression of uncertainty which has become so prevalent. While it is doubtful if the main forecasting line is to make a downward turn,[2] it is clear that September data did not furnish as favorable a forecast as has been the case in the preceding months since June. Prices were on the upgrade during the latter part of September, but during part of the month the price level showed considerable weakness, and the physical volume of trade was forging ahead so rapidly as to suggest doubt as to the strength of future markets.

The sensitive six-commodity price index, Fig. 1, declined in September, as did the index prepared by the Bureau of Labor Statistics. This is due to the fact that these indexes are averages for the month and were affected by the setback which came during the first half. Bradstreet's and Dun's indexes, which are compiled as of October 1, showed gains over September 1.

The gist of the situation is that the existence of considerable overcapacity in production constantly threatens a too rapid increase in the output of several basic commodities. The sharp gain in production of steel, for example, has helped to prevent a recovery in finished steel prices. In the same way the rapid increase in the volume factor in the P/V ratio has tended to limit the advance in the general average of prices and to slow up the upward trend of that index.

The general forecast for the next six months continues moderately favorable. No grounds for a material industrial recession have yet appeared. It seems likely that the P/V line will resume its upward course and that the outlook for moderately advancing prices and improved business profits will accordingly continue favorable for some time. The threat of radical legislation, to which attention has been called in these columns for several months, is now better appreciated and has had some effect in slowing up business. We are, moreover, just at the turn of a business cycle, and, as usual, recovery is halting and irregular. At this stage business men are always uncertain as to whether the gains made will hold. In this connection attention is called to the soundness of the position we have taken, namely, that the general recovery in business would probably not occur until about October. This position now seems thoroughly justified. While several important industries have already clearly reflected an upward turn, it is likely that the whole industrial structure, including wholesale and retail trade, will not be clearly in the stage of recovery until the end of this month.

October should tell the story. If, as now seems probable, the data for this month reflect improvement in trade, it is believed that a general upward swing



Data on the compilation of this curve can be obtained upon request to the editors. October data are estimates.

FIG. 1 THE BAROMETER OF INDUSTRY AND TRADE

of at least moderate proportions will continue throughout the first half of the year 1925.

---

[1] Assisted by Horace J. Barney, R. H. Leding and Harry Corash, of the Bureau's Staff.

[2] The V factor was increased in September by unusually large grain tonnage.

RECENT DEVELOPMENTS

1. The Dawes' plan for European settlement was put into effect by the successful completion of the German loan and general progress was made towards industrial recovery in Europe.
2. Mail order sales and post office receipts showed decided gains (after eliminating seasonal variation), suggesting that the gains in buying power of rural sections have begun to find expression in orders. (Fig. 11).
3. It became apparent that certain important basic industries which have been much depressed have hit bottom, among which may be mentioned textiles, leather, and petroleum. While these industries are still at low ebb the beginning of recovery is at hand.
4. Heavy marketings of grain at high prices have continued. Under the influence of wet weather the European crops have been seriously damaged and Canadian harvests delayed.
5. Unfilled steel orders followed up the reversal of their downward trend, which occurred in August, with a fair gain in September. (Fig. 3).
6. The production of bituminous coal has gained momentum at the same time that prices have been gradually growing firmer. (Fig. 5).

FAVORABLE FACTORS

1. Money rates continue low and credit easy. (Fig. 12).
2. Stocks of the majority of the commodities listed in Table 1 show further liquidation.
3. Production activity, especially in manufacturing, is low relatively to railway shipments. (Fig. 2).
4. Labor employment and earnings increased slightly or at least held their August gains. (Fig. 8).
5. Business failures decreased, new enterprises increased. (Fig. 13).
6. Building activity appears to have reached bottom and showed a small recovery in September. (Fig. 6).

In addition, the points listed under recent developments may be mentioned as, on the whole, favorable.

UNFAVORABLE FACTORS

1. Bank debits showed a small decline in September (Fig. 10).
2. Automobile production and sales have decreased slightly.
3. Political uncertainty has become an operative factor affecting future buying.

FUTURE DANGERS

1. The possibility of further gains by the La Follette party, with the further possibility that the election may be thrown into the House. It is becoming increasingly probable that the next Congress will be one given to conflict between radical and conservative elements.
2. Great changes are bound to occur in the shape of readjustment of world industry and finance. While in the end these will be beneficial, many of the immediate effects will be injurious to particular industries. The steel industry, in particular, is going to meet increasing competition from European countries.
3. If inflation continues to make progress there will almost certainly come a severe crisis within a year or two.
4. We have always with us the existence of great overcapacity in certain industries, coupled with a high level of wages and prices which it is difficult to maintain. If these industries are run at capacity their products must fall in price and the existing wage rates cannot be maintained. If they are not run at capacity, depression exists.

Weighing all the various complicated factors in the existing situation, it seems probable that business will continue to make moderate and irregular recoveries which will be more in the nature of stabilization than of boom. The depressed industries will complete the liquidation process and gain a stronger position, while those industries which have been most prosperous will not be able to make much gain and in some cases will fall back. This condition is likely to exist for several months.

Two main factors furnish the chief hopes for a more decided gain to follow this stabilization period: (1) The improved purchasing power of farmers, and (2) the immediate effects of the European recovery.

The later effects of the European readjustment seriously threaten stability in American industry. Following the immediate purchases (based on extensions of credit which are now being made), there will come a period when we must import more heavily and lose a part of our gold supply. The raw materials purchased will be turned into manufactured products which will (1) be shipped into this country, or (2) be sold in competition with our products in the export market.

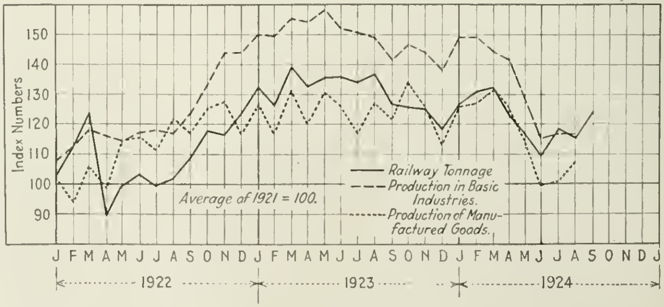
The result will probably be that we will have to face a period of declining prices and wage reductions which alone will enable us to find an export market for the excess capacity of such industries as steel, copper, textiles, oil, meats, and leather.

Inflation, aided by farm prosperity and immediate European purchases, will probably keep us on the upgrade for another six months or so, but after that we look for the strain of great readjustment.

Production and Stocks of Commodities

Production on the Upgrade: Stock Liquidation Continues

As shown in Table 1, there was a rather general tendency toward liquidation of stocks of various commodities during August. Considerable decreases were shown as of September 1 in leather, tires, raw sugar at refineries, and



Sources, Federal Reserve Board; N. Y. U. Bureau of Business Research. Railway tonnage and production in basic industries corrected for seasonal variation, and the latter also for normal growth.

FIG. 2 RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH

Average for 1921 = 100. Gasoline, raw sugar, cottonseed oil and Dept. of Commerce index adjusted for seasonal variation.

MONTH AND YEAR	GASOLINE	LEATHER (Cattle)	ZINC	NEWSPRINT PAPER	AUTOMOBILE TIRES	RAW SUGAR	COTTONSEED OIL	MERCHANT PIG IRON	DEPT. OF COM. INDEX OF STOCKS—45 COMMODITIES
	100 = 630,757,000 gals.	100 = 19,742,000 pieces	100 = 77,202 tons	100 = 30,009 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.	100 = 634,950 tons	100 = 132
Jan. 1923	156	85.3	23 6	64.0	105.4	55.0	52.0	35.8	87.7
Feb.	156	84.0	21.5	76.7	107.6	76.0	60.0	43.0	84.1
Mrr.	154	82.6	14.1	77.3	119.7	86.0	64 5	44.0	84.8
Apr.	162	81.6	13.0	67.2	129.9	168.0	67.0	38.0	84.8
May	164	81.4	11.6	62.9	139.3	147.0	69.0	41.7	80.4
June	173	82.1	16.9	60.5	159.6	97.0	71.0	53.6	83.3
July	174	82.8	22.2	65.0	161.4	97.0	76.0	72.7	82 6
Aug.	185	83.6	27.5	74.0	148.0	96.2	74.0	97.5	90.6
Sept.	199	84.3	34.4	85.5	138.5	81.8	57.4	111.0	95.5
Oct.	206	84.2	29.6	82.2	123.2	130.4	28.0	121.7	85.5
Nov.	211	85.4	33.4	82.4	111.7	102.8	43.0	131.0	88.4
Dec.	202	85.8	40.3	80.0	107.5	89.8	43.3	141.0	90.6
Jan. 1924	186	87.0	47.3	78.8	99.0	79.0	52.5	145.0	98.6
Feb.	187.5	79.5	52.7	94 6	110.0	54 5	53.5	144.5	97.8
Mar.	188	83 8	48.0	101.0	120.5	90.0	58.5	140.0	98.6
Apr.	203	81.2	41.5	103.0	132.0	143.0	60.2	139.5	98.6
May	197	77.2	42.5	105.6	141.3	125.6	63.2	148.6	102.9
June	214	78.0	54.9	114.9	140.1	99.4	62.4	158.8	95.7
July	220	77.0	64.3	111.4	141.1	108 9	68.2	164.2	94.9
Aug.	232.5	75.0	68.3	94.8	117.7	114.7	56.9	165.6	97.1
Sept.	207.8	71.0	66.0	94.0	102.6	82.1	45.1	157.2	.....
Oct.	.....	.....	59.2	.....	.....	77.2	....	.....	.....

cottonseed oil. Stocks of zinc were down as of October 1. The latest information shows that a decreasing tendency exists in stocks of merchant pig iron. Gasoline, however, continues to show a bad situation and the price of that commodity is weak.

Production and Railway Tonnage

Production. The index of production in basic industries held level in August at 116.9 per cent of the 1921 average (Fig. 2). This is slightly up from the June low point of 115.7. The recent course of this index suggests a period of stabilization in industry. The production of manufactured goods, however, rose sharply during August.

Railway Tonnage. It is estimated that the Class 1 Railways in September hauled about 122.2 million tons against 112.5 million in August. The adjusted index of railway tonnage stands at 124.4. The facts show a sharp gain in railway shipments, notably in grain and coal.

Conclusion. Relatively great increase in railway tonnage has put the tonnage curve higher than those representing production, for the first time since 1922. Rail shipments have gained on industrial output, showing that the liquidation of stocks in first hands has made much progress. This appears to be the usual situation in the early stages of recovery in the business cycle.

Iron and Steel Production

Production. In September the pig iron and steel ingot average daily production increased approximately 9 per cent and 11 per cent, respectively, continuing the upturn of August (Fig. 3).

Unfilled Orders. The unfilled orders of the United States Steel Corporation also continued to advance, showing a gain of 184,000 tons over the previous month.

Prices. The pig iron price composite of the *Iron Age* held at $19.46, while the finished steel composite price eased off to 2.474 cents as compared with 2.496 cents for August. The market displayed no particular strength.

Conclusion. The tendency is to overemphasize the effects of the change from "Pittsburgh plus," on the steel business. As it occurred during a depressed period it was merely used to explain the irregular condition which would have prevailed anyhow.

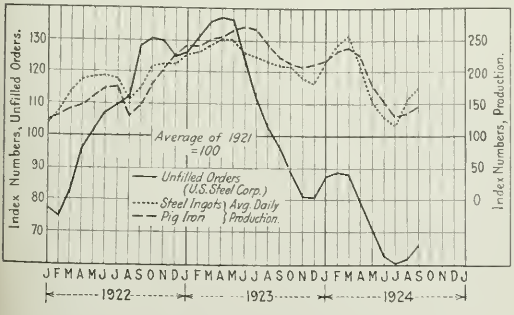
It is true that the production of iron and steel has increased during August and September, but this recovery is not unusual considering the drastic nature of the curtailment from March to July.

We wish again to point out that buyers still have the upper hand. Requirements for the rest of the year have been largely filled and buyers are apparently refusing to contract for first quarter business at asked prices. Consequently, we do not look for price recovery in the immediate future. Although it is still believed that it is safe to cover requirements for the balance of 1924, there seems to be no hurry to contract for more than present needs.

Production in Important Industries

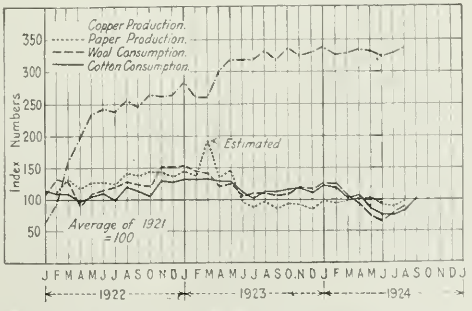
Copper. The continued increase in copper production (Fig. 4) has tended to cause accumulation of stocks. At present prices the market is very quiet and unless export demand develops further, a reduction either in prices or in production will be necessary. The small price advance following the German loan suggests that export demand may relieve the situation and bring firmer prices.

Paper. Fundamental conditions in the paper industry are better. After the recent cut in newsprint (probably due to Canadian competition), prices are firm and stocks remain low. Production for August was still below the level of 1921. Indications point to im-



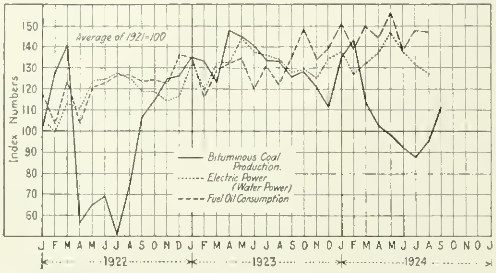
Sources, Iron Age; American Iron and Steel Institute. All curves corrected for seasonal variation.

FIG. 3 IRON AND STEEL PRODUCTION AND UNFILLED ORDERS



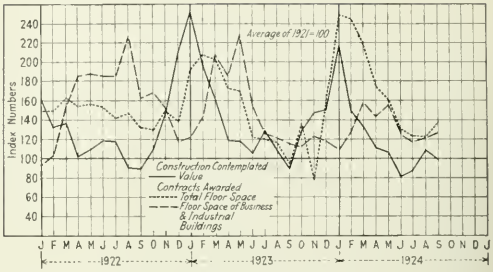
Sources, American Bureau of Metal Statistics; American Paper and Pulp Association; Bureau of Census; Department of Commerce. Cotton and wool curves corrected for seasonal variation.

FIG. 4 PRODUCTION IN FOUR IMPORTANT INDUSTRIES



Sources, Department of Interior; Bureau of Mines; United States Geological Survey. Bituminous coal and electric power curves corrected for seasonal variation.

FIG. 5 FUEL AND POWER PRODUCTION



Source, F. W. Dodge Company. Construction contemplated and total floor space curves corrected for seasonal variation.

FIG. 6 BUILDING CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

provement and increased production.

Wool. Consumption figures for August were nearly 30 per cent above the low point reached in June of this year. Stocks of raw wool have been much depleted, and with the large increase in manufacturing activity prices should continue strong. Increased demand and better prices for woolen fabrics are causing a rather rapid recovery.

Cotton. Consumption of cotton by textile mills increased 21.8 per cent during September. Unsettled conditions in the raw cotton market, however, have caused some hesitancy in the demand for cotton textiles. Continued low prices for raw cotton should stimulate both production and demand, but the very low condition of manufacturers' stocks of raw cotton must be kept in mind in considering the price trend. A continued moderate gain in production at slightly lower prices seems probable.

Conclusion. Manufacturing conditions are uneven. In industries where production is still far below normal, further recovery is naturally to be expected. In no case, however, is there any sign yet that the resumption in activity can be more than moderate.

Fuel and Power

Coal. September showed a continued increase in the production of bituminous coal, the output in that month being approximately 41 million tons against 35 million tons in August (Fig. 5). Our adjusted index now stands at 111.2 per cent, higher than the 1921 average for the first time in five months.

Hydroelectric power. The figures for August show a decrease which was greater than usual. The adjusted index stands at 127.3 per cent.

Fuel Oil. The indicated consumption of fuel oil in the United States held practically unchanged during August. This may be considered a strong showing in view of the decreased manufacturing activity in that month. The adjusted index was 147.5.

Conclusion. The outstanding fact is the large increase in coal output and consumption, accompanied by firmer markets for that product. The price of bituminous coal has been gradually creeping upward since the middle of July. The fuel oil market is firm and is not likely to be any lower in the near future. The decrease in hydroelectric power output merely reflects the depressed industrial condition which prevailed in August.

Building Activity in September

Contracts Awarded. The floor space in contracts awarded showed an increase, although a decrease is usual in September (Fig. 6). This puts the seasonally adjusted index up 12.6 per cent over the figure for August. It does not seem likely that construction activity will again reach the levels maintained for the past two years, but the moderate improvement shown is one of the favorable factors in the present situation.

Contemplated Construction. The seasonally corrected September index receded slightly after the sharp increase registered in August.

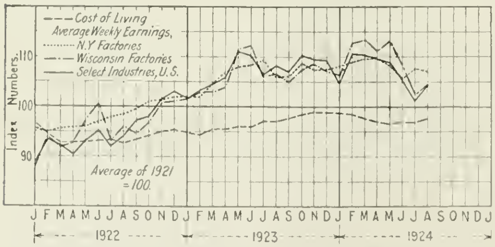
Conclusion. Although the bottom of the recession in building apparently has been passed, there is no reason to expect anything in the nature of a boom. Until building costs come down, the most that can be expected is a continuation of moderate activity.

Wage and Employment Situation

Earnings Increase: Employment Holds Gains

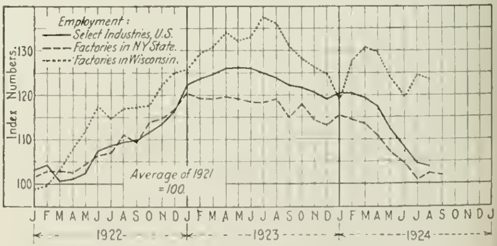
Earnings and Cost of Living

Selected Industries in the United States. (Fig. 7). Factory earnings in the United States increased slightly to an index of 105.9 for the month of September.



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin; National Industrial Conference Board. New York and Wisconsin curves corrected for seasonal variation.

FIG. 7 WAGES AND COST OF LIVING



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin. All curves corrected for seasonal variation.

FIG. 8 TREND OF EMPLOYMENT

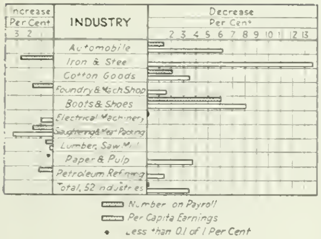


Fig. 9 Trend of Employment and Earnings, August 1924

New York State. In September, New York factory earnings increased a little over 1 per cent, to an index of 108.5.

Wisconsin. In August average weekly earnings recovered partially from the July decline. The seasonally adjusted index is now 104.7.

Other States. Average per capita earnings of factory employes increased 0.8 per cent in Illinois, 0.4 per cent in Pennsylvania, and 2.2 per cent in New Jersey. There figures do not allow for normal seasonal changes.

Cost of Living. In August the index of cost of living in the United States increased 0.7 per cent. The rise was due to advances, largely seasonal, in food and clothing.

Conclusion. The general slight upturn in earnings indicates an unsettled condition in wages, which will last for several months.

The Employment Trend

United States. (Fig. 8). Employment throughout the country turned upward in September to an index of 104.6 from an August level of 103.9.

New York State. The seasonally adjusted index of factory employment increased slightly in September, from 102.2 to 102.5. The actual number employed, however, increased over 3 per cent. Increases occurred in practically all industries except those producing building materials.

Wisconsin. The August index decreased slightly, both before and after elimination of normal monthly variations. Employment in Wisconsin is 23.7 per cent above the 1921 average.

Other States. September reports from Illinois, Pennsylvania, and New Jersey showed gains in employment over August, respectively, of 0.6, 2.2, and 2.3 per cent.

Conclusion. The latest reports show that employment is about holding its own. Advances in actual numbers employed are mainly seasonal. The general trend, however, continues at a level which suggests later gains.

Employment and Earnings in Ten Selected Industries

Employment. Increases occurred in four of the industries analyzed and decreases in six. The largest increase was boots and shoes, 6.1 per cent; and the largest decrease iron and steel, 2.7 per cent (Fig. 9).

Per Capita Earnings. Increases took place in seven of the industries while decreases occurred in but three. The greatest increase was in iron and steel, 13.7 per cent; and the largest decrease in slaughtering and meat packing, was but 3.3 per cent. In all 52 industries there was an increase of 3.5 per cent.

Immigration and Emigration

July figures show a large decrease in immigration and a considerable increase in emigration. The net gain was the smallest in recent years. The greatest drops were in immigrants from Italy, Canada and Newfoundland, Mexico, and the West Indies.

Date	Immigrants	Emigrants	Net Gain
July, 1924	11,661	8,493	3,168
June, 1924	36,309	6,831	29,478
July, 1923	85,542	8,041	77,501

Trend of Trade and Finance

Trade Volume Stabilized: Price Situation Irregular

Bank Debits and Postal Receipts

Bank Debits. The average weekly volume of checks drawn (with seasonal variation eliminated) declined during September, but maintained a level higher than in any other month for four years, except August, 1924.

Postal Receipts. In September the index of receipts of 50 selected post offices, adjusted for seasonal variation, was 129.9. (Fig. 10).

Conclusion. These two indexes taken together show a decided gain in the dollar volume of business. The volume of trade is now about normal. Retail trade is gaining on wholesale trade, as is common in the early stages of business recovery.

Retail Trade

Mail Order Sales. A sharp recovery is shown by the sales of the two leading mail order houses for September (Fig. 11). Although mail order sales have averaged higher in 1924 than in any of the three years preceding, this is the first statistical evidence of the increased buying power of farmers.

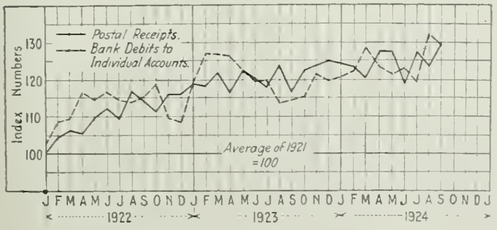
Chain Store Sales. A slight decline in the sales of the four leading dry-goods chains leaves them still 47 per cent above the average for 1921.

Department Stores. Sales increases were slightly less than is usual in August. Stocks of merchandise held by department stores have been declining steadily, however, and demands from this source should soon prove a stimulating factor in wholesale trade.

Conclusion. Except in the case of mail order sales it is too soon to expect much improvement in retail trade. The upward turn in all lines should be reflected in sales figures for October.

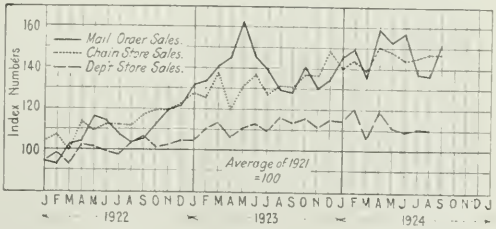
Prices and Interest Rate

Prices. Bradstreet's index of com-



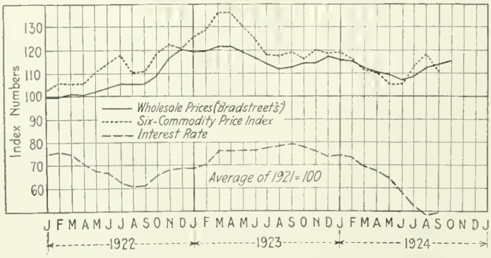
Sources, Federal Reserve Board; Post Office Department. Both curves corrected for seasonal variation.

Fig. 10 Bank Debits and Postal Receipts



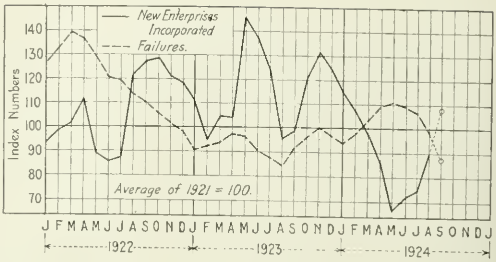
Sources, Commercial and Financial Chronicle: Federal Reserve Board. Data cover 2 mail order houses, 4 chain stores, and 306 department stores. All corrected for seasonal variation.

Fig. 11 Sales of Mail Order, Chain and Department Stores



Sources, Commercial and Financial Chronicle; Bradstreets. Interest rate is the monthly average, corrected for seasonal variation.

FIG. 12 WHOLESALE PRICES AND INTEREST RATE



Sources, Dun's Review; New York Journal of Commerce. Both curves plotted as a 3 months' moving average, centered and corrected for seasonal variation.

FIG. 13 NEW ENTERPRISES AND BUSINESS FAILURES

modity prices registered an advance of 1.4 per cent during September (Fig. 12). Dun's index was also up over 1 per cent, and Dun's list shows a steady excess of advances over declines. The Fisher weekly index has recently been advancing. The price situation has been decidedly irregular of late.

The special six-commodity index showed a decline in September, chiefly due to the lower price of cottonseed oil which usual at this season. The decline in this index clearly indicates the recent price unsettlement.

Interest Rates. Rate on best commercial paper became firmer in September. The call loan market has also been a little firmer.

Conclusion. The recent slowing up in price advances shows the danger of increasing our industrial output too rapidly. It is probable, however, that prices will continue to advance irregularly for at least several months.

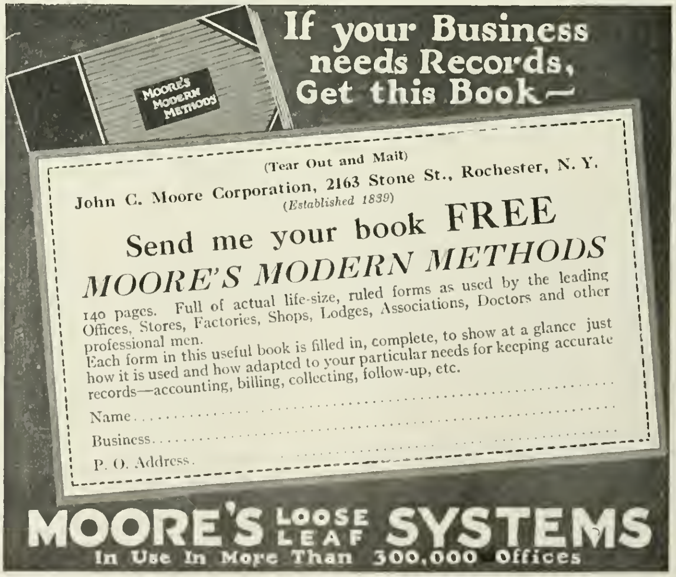
The money market is practically certain to continue easy until the turn of the year, but should rule firmer than in August.

New Enterprises and Failures

New Enterprises. The index of capitalization of new concerns stood at 108 per cent. The trend of the three months' moving average shown in the graph has been up for three months.

Business Failures. The index of failures during September, 87.3, was the smallest for any month since September, 1923 (Fig. 13). There has been a rather steady decrease since last May.

Conclusion. The continued decrease in failures indicates the completion of liquidation and a better chance for profits in business. The increase in new enterprises is strong evidence of an improved sentiment and greater confidence among bankers and business men concerning the future.



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VOLUME VIII NOVEMBER, 1924 NUMBER 5

Coal Storage and the Railroads

By R. H. AISHTON

President, American Railway Association

Index Number
662.65 Coal
658.78:662.65 Storage of coal

THE "Burning Question," whether it be sentimental, political, or of more practical application, that of: "Where is our winter coal coming from?"—must be answered. The question has been cussed, discussed, and debated upon from all angles. It is the purpose of this brief article to throw additional light on the question from the standpoint of the railroads.

It is contended that the total volume of coal required for consumption during the present year will not equal that of previous years (with the possible exception of the year 1921) because of the depression in certain lines of industry. But it is highly significant that, regardless of the pessimism shown in some quarters, the car loadings on the railroads, as a whole, for the period January 1 to August 23, 1924, *(exclusive of coal and coke)* totaled approximately 25 million cars, or only 1.3 per cent less than the number loaded during the same period in 1923, which was a banner year. This does not indicate a business depression, for, with the exception of the record year of 1923, car loadings, which are a barometer of business conditions, are higher than in any similar period. Even exclusive of coal and coke, the loadings for 1924 to August 23, exceed the total loading of all commodities in the same period of 1921. So much for present business conditions.

The Geological Survey reported that as of January 1, 1924, the reserve stocks of coal on hand amounted to 62 million tons. This represented approximately 46 days' supply for the country as a whole, providing the reserve stocks were evenly distributed for all purposes, which is never the case. Since March 1, 1924, it is estimated that the weekly rate of consumption has exceeded the weekly rate of production until at the present time the reserve stocks on hand have been very materially reduced, according to the best information we are able to obtain.

The railroads as of August 1, 1924, were carrying in storage and in cars 13,986,267 tons as compared with 14,098,776 tons for the same date in 1923, or within 112,509 tons, or eight-tenths of one per cent, of the

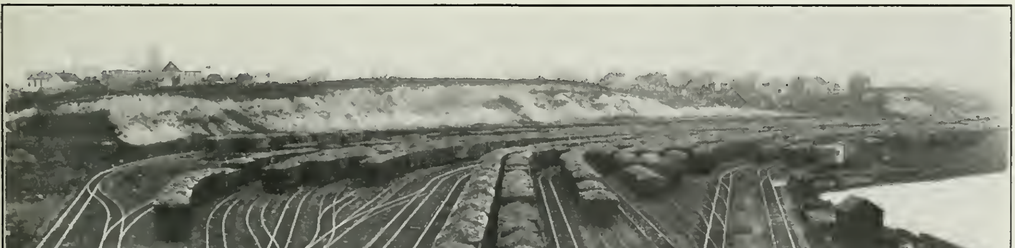

FIG. 1 COAL IN THE NEW YORK CENTRAL YARDS AT ASHTABULA, OHIO, AWAITING SHIPPING OUTLETS TO THE NORTHWEST

amount of coal in storage a year ago. Stocks of local dealers, however, were low.

From the standpoint of transportation, the territories presenting the most difficult coal problems are New England, northern New York, northern Michigan and the Northwest. The gateways to these territories, and in particular to New England, northern New York, and northern Michigan, are the limiting or controlling factors which determine the volume of traffic that can be handled currently. In the event railroad operations are hampered and impeded by storms and snow blockades, coincident with an abnormal demand for coal and a peak movement of other commodities, the inevitable result is congestions, delayed movements, and embargoes.

The coal consumed in New England is usually handled by rail and water and by all-rail movement from the coal fields in Pennsylvania, Virginia and West Virginia. In addition, there is some coal imported which is produced by mines in Wales. New England is used for an example by reason of the fact that definite statistics are available on the movement of coal into that territory. What is true in that section may be used as a criterion for the country as a whole.

The total rail and water movement of bituminous coal into New England for the year 1924 to August 1, was approximately 5½ million tons, as compared to a total of about 7¼ million tons for the same period last year. That the movement is less this year than last year is not particularly startling, but when comparison is made with 1922 and found to be even less than at the same time in that year by approximately 400,000 tons, it becomes highly significant.

Another example of the lack of foresight in providing for the winter fuel supply may be found in the Northwest District. Coal is moved into this section principally by lake, although there is also an all-rail movement from the coal fields of Illinois, Kentucky, Ohio, Pennsylvania, and West Virginia. The movement of coal via rail to the lower ports on Lake Erie, where the railroads have provided ample facilities for transfer to boats for trans-shipment to the upper lake ports, is an insurance of an adequate supply of fuel coal for the Northwest and the upper peninsula of Michigan, if advantage is taken of the facilities before the season of navigation closes on the lake.

Shortsighted Policy of the Northwest District

The volume of bituminous coal trans-shipped across the lake for the period January 1 to August 25, 1924, totals in the neighborhood of about 13 million tons as compared with almost 19 million tons for the same period of 1923. While this is nearly 6 million tons short of last year's receipts, there were about 2 million more tons of coal on hand at the head of the lakes as of April 1, 1924, than was the case on the same date in 1923. April first comparison is made to coincide with the beginning of the coal year, and also because at that time a complete inventory can be made of coal left over from the previous season, due to the fact that navigation on the lakes had not yet opened.

This presentation shows the Northwest District still considerably short of its fuel requirements. Undoubtedly these requirements can and will be met; yet it is clearly apparent how much easier it would have been for the carriers to handle this tonnage during the time when the seasonal crops were not making full demands on transportation.

The movement of crops from the Northwest is seasonal and can be depended upon to start at about the same time each year. It is a known quantity. The fuel requirement of the Northwest is also a known quantity but is not seasonal. Therefore, it would be to the interest of every person in that territory, and to the railroads serving them, to store coal as early in the year as possible, thereby removing from the peak weeks of transportation demand the coal tonnage which should have moved prior to the peak, and leaving the gateways open and uncongested for the free and expeditious handling of their harvests.

Coal production for the first 36 weeks of this year amounts in round figures to about 302 million tons, nearly 75 million tons less than were produced in a like period of last year. Requirements for the country as a whole are conservatively estimated at about 480 million tons. Therefore, to meet these requirements it will be necessary, in the remaining 16 weeks of this year, to produce weekly an average of over 11 million tons of coal, or 2½ million tons more than is now being produced. The longer the production remains low, the greater the danger of a coal shortage.

Railroads Not Responsible for Coal Shortage

The railroads today, as has been testified to generally by shippers and receivers throughout the country, are in much better shape, from a physical standpoint, than ever before. They are carrying, on September 1, in storage a surplus of nearly 7,000 serviceable locomotives and 120,000 serviceable open top cars immediately available to meet the peak coal movement which it is expected will be handled during the next few weeks. This condition has maintained for the past eight months and it should be distinctly understood that, so far as the railroads are concerned, every endeavor will be made to see that the fuel requirements of the country are met. But it should be just as distinctly understood that should some local shortages occur, created by reason of the bulk of coal production falling heaviest on a limited number of railroads at a time when the seasonal crops are heaviest, the railroads *cannot* be held responsible for such shortage and consequent sky-rocketing of coal prices.

Reverting now to our original assertion that the "Burning Question" must be answered, we are confronted with but one possible solution—early storage against what experience has taught us will be our normal requirements. Through no other channel may we expect solution. We have unquestioned authority for the statement: "The winds are tempered to the shorn lamb;" but there is no argument advanced tending to prove that the improvident man—householder or industrial executive—without coal is as comfortably fixed as the provident man who has it.

Putting Locomotive Cranes to Work

Types of Greatest Use in Manufacturing Plants

By GEORGE E. TITCOMB

Eastern Branch Sales Manager, The McMyler Interstate Company

THE locomotive crane has released more men from outside labor in manufacturing plants than any other single agency. Other types of handling equipment, singly or in combinations, have been applied to many outdoor jobs in special cases. But such apparatus usually is designed and built for indoor or stationary work. The locomotive crane is the mobile industrial giant that replaces human effort in the yard.

The earliest use of such cranes continues to be one of their important applications, namely, lifting and carrying loads by means of a hook and slings. This kind of a rig is known as the hanging block type. The block holding the hook carries one or more sheaves for the wire hoisting cables.

A 35-ton[1] standard-gage, steam-driven, locomotive crane, rigged with a hanging block, is shown in Fig. 1. This crane is handling billets by means of sling ropes. The crane in the course of its loading and unloading work is called upon to shift full and empty cars, either on the same track, by means of car coupling attachments, or on an adjacent track by means of a bumping pole. From 5 to 8 full freight cars of 40 to 50 tons capacity can be moved in this way.

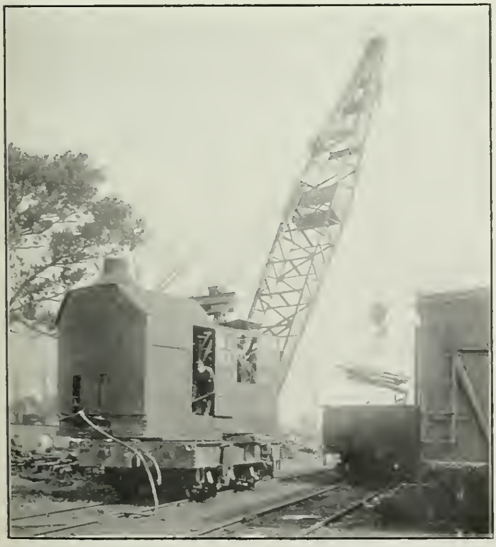

FIG. 1 A HANGING BLOCK RIG IS USED FOR ORDINARY WORK

Index Number
658.281 Mechanical handling
621.87 Locomotive cranes

The boom of this crane is 50 ft. long, a length which has become standard among crane manufacturers, and which is supplied unless the customer desires a longer, or in fewer cases, a shorter boom. The reason back of this length is found in the size of open freight cars, which now come up to 46 ft. inside measurement from end to end. A 50-ft. boom enables the crane operator to reach to the far end and unload a car of loose material, like coal, by bucket, or of pig iron by magnet, without the help of any labor, except for cleaning up the final odds and ends.

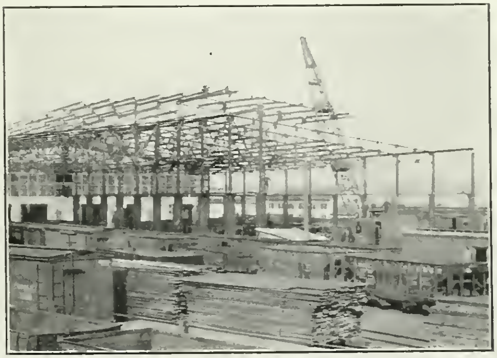

FIG. 2 CRANES ARE OFTEN USED FOR BUILDING CONSTRUCTION

Locomotive cranes often are of great service in construction work around a plant, or in the repair or tearing down of buildings. When a new power-house is to be built it has often been the practice to buy a crane previous to starting the work and to use this crane in removing the excavated dirt, driving piles where necessary, installing foundations, handling sand, gravel, and concrete for the footings and machinery foundations, setting the steel work, and handling building materials during the course of erection. After the building is completed the crane is rigged with a bucket to unload and store the coal for the plant and sometimes handle the ashes.

Fig. 2 shows a 35-ton crane operated by the Bessemer and Lake Erie Railroad. This crane is equipped with a hanging block and is being used to erect the steel work of the addition to the building shown in the photograph. The 70-ft. boom makes it possible to pick up the structural shapes and swing them to the roof in position for setting. Fig. 3 shows a locomotive crane

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[1] The capacity of a locomotive crane is rated by agreement among crane manufacturers at the load it will lift on a 12-ft. radius from the center line of pivot to the cable.

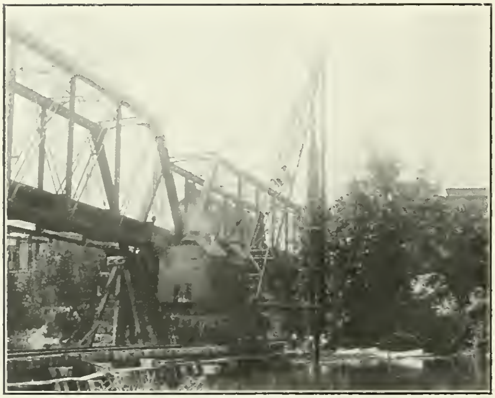

FIG. 3 PENDULUM PILE-DRIVER FOR LAYING FOUNDATIONS

equipped with a pendulum pile-driver to establish footings for a foundation.

The standard locomotive crane is extensively used for production work in many places. When assembly or erection jobs involve the handling of heavy parts, and the work cannot be done inside of a shop where overhead traveling cranes are available, the locomotive type fills the bill with entire satisfaction.

Such a condition prevails at shipyards. Vessels are built on ways and the most convenient place to locate the materials for their construction is alongside of these ways. Flexibility and economy of work require that it shall be possible to move these parts in practically any direction, to considerable height, and to swing them into places hard to reach. For this purpose the locomotive crane is ideal in every respect.

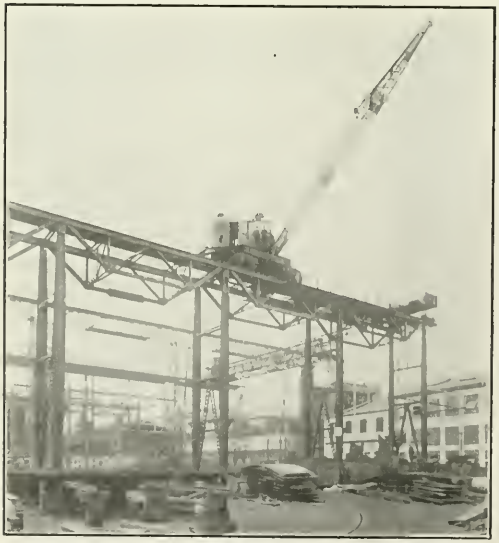

FIG. 4 BOAT BUILDING CRANE IN CRAMP'S SHIPYARD

A 35-ton crane with a 70-ft. boom, employed in this work at the Wm. Cramp and Sons Ship and Engine Building Company shipyard, is shown in Fig. 4. Materials are brought by railroad cars to points underneath the trestle, where they are unloaded by the crane and stored until wanted. As locomotive cranes can swing through a complete circle, the relative location of the material is not important. When plates and other parts are needed the crane picks them up, carries them along the trestle to the ways, and assists in installing them at the point of use.

It is not always convenient to provide railroad tracks for a crane. At times, the crane may be needed at points where such tracks cannot possibly be installed. The crawler-tread type has been developed for service in such cases. Moreover, it can climb a 30 per cent grade without difficulty.

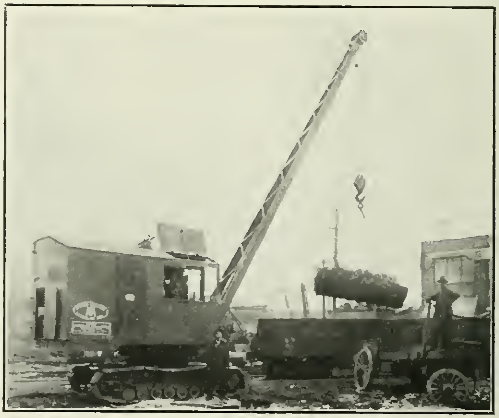

FIG. 5 THE CRAWLER-TREAD CRANE CAN GO ANYWHERE

The Perry, Buxton and Doane Company use a crawler-tread crane of 10 tons capacity. This particular crane is rigged with a hanging block, and is supplied with a 36-in. magnet, as well. In Fig. 5 it is shown handling a skip filled with scrap. As such cranes practically never have to work from the end of a car, they can be equipped with a shorter boom. The one in the picture is 40 ft. long.

This particular crane is gasoline-driven, a type which proves very desirable in many plants. Power for the magnet is obtained from a 5-kw. generator set installed in the cab. The plant also requires the use of a ½-ton bucket in some of its handling operations. For this purpose the hanging block and cable are removed and a bucket and cable rig are fitted on the crane. It takes about a half-hour to make this shift.

In many cases bucket operation is the main service to which a plant applies its locomotive cranes. Chief among such uses is the handling of coal, coke, sand, and ore. Fig. 6 shows a crane in use at the Chicago plant of the Standard Oil Company. This crane is of the 20-ton type and is used to unload coal to the stills. It is fitted with the standard 50-ft. boom.

Cars of coal are shifted into position alongside of the stills, by the locomotive crane. No helper is needed in the coal car. The filled bucket is hoisted and discharges its load directly into one of the circular storage hoppers shown in the picture. From this point the coal feeds by gravity to the stills.

It is sometimes necessary to operate locomotive cranes in very crowded quarters and under conditions where railroad cars must be shifted without interference in practically the same space. These conditions arise most frequently in plants already operating, and where the location of buildings, property lines, roadways, or the like, prevent the laying of additional tracks, or the blocking of the way while using a crane of the crawler-tread type.

Fig. 7 illustrates a case of this kind. The crane shown is used by the Camden Coke Company for the handling of coke. It is of the 20-ton type and is rigged with a 1-ton bucket. The boom is 50 ft. long.

As shown in the illustration this crane straddles a railroad track running beneath it. The gage of the crane structure is 15 ft. 6 in. and the height is made anywhere from 16 to 22 ft. to permit a man to stand up inside of the open car without danger when the car is moved beneath the crane. The crane body revolves on rollers. Electric power from a third rail system on the ground level drives the crane by means of a 75-hp. motor.

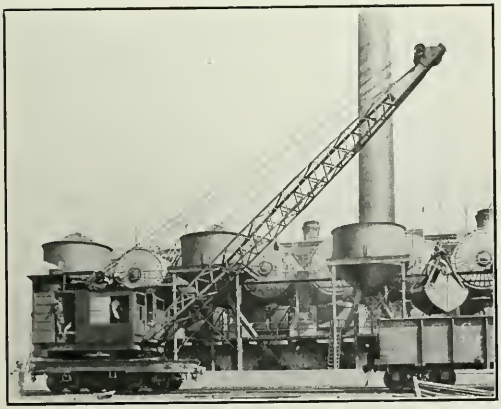
FIG. 6 HANDLING COAL WITH A GRAB BUCKET

Locomotive cranes are very extensively used for handling coal by means of buckets. This service is employed in manufacturing plants as well as in central stations.

The crane shown in Fig. 8 is used at the power station of the Dayton Light, Heat, and Power Company. It is a steam-driven crane, wide gage, and runs on double trucks. It is equipped with a non-elevating boom 100 ft. long in order to reach to distant points of the storage pile. The use of such a long boom requires special bracing to support the load. This bracing takes the form of tie rods which are supported on a super-structure built on top of the crane. As the quantities of coal handled are very large and speed of operation is important, this crane was built to handle a 4-ton bucket with which it is shown equipped in the photograph.

In many plants the yard is level or the area to be served by the crane is limited so that a concrete roadway or other type of firm roadbed can be constructed. A crane which is meeting with growing favor among manufacturers who are so situated as to be able to take advantage of such conditions is shown in Fig. 9. This crane runs on tractor wheels made 12 in. or more on the face. On smooth, level roadways the tractive effort of such a crane is sufficient to drive it economically and no slipping occurs. This crane has also some of the advantages of the crawler-tread type.

The crane in the picture is of the 10-ton type. It is equipped with a 40-ft. boom and is operating a ½-ton bucket. This particular crane is used by the Municipal Construction Company in unloading sand, building supplies, and similar materials. It can also operate a hanging block or a magnet.

Crane for Allround Service

Fig. 10 shows a crane used by The Richardson and Boynton Company for a great number of purposes connected with foundry services. The crane shown is of the 20-ton type. It is equipped with the standard 50-ft. boom and in the photograph is shown using a 45-in. magnet. Fitted up thus, it is employed in unloading cars of pig iron.

This crane is used in handling all sorts of castings and foundry supplies and equipment by taking the magnet off and using it with the hanging block and slings or chains. The hanging block is replaced by a 1-ton bucket when it is necessary to handle sand, clay, coal, coke, or any other loose material. These materials must be stored up by northern foundries during

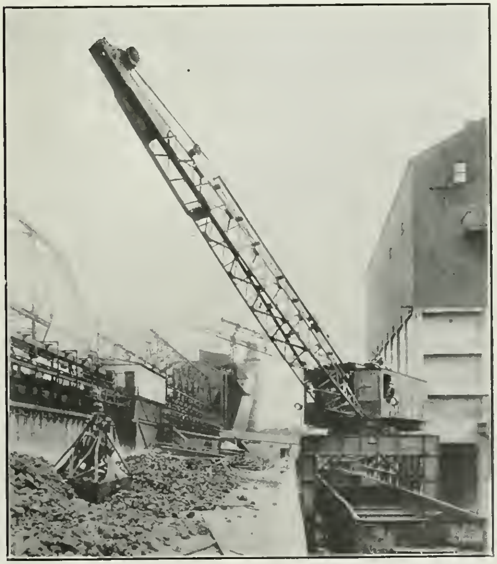
FIG. 7 CRANES CAN BE USED IN CROWDED QUARTERS

the open season of the year because of freight tie-ups and embargoes which are often enforced by the winter season. Consequently large quantities must be handled by the crane in a very short time in order not to tie up regular plant operation.

On this particular crane it is possible to average a high rate of handling. Record runs are, of course, of not much value as indexes of operation and so the figures actually obtained by time study on the crane will not be given here. But day in and day out, this crane averages the unloading of one car of pig iron of 40 to 50 tons in 20 min., one car of coke in 30 min., and one car of sand in 45 min., which is also the time required to unload a car of bituminous coal.

As is customary in almost every industrial plant the crane shown in Fig. 9 is also used for loading cars with the product for shipment, and in switching and shifting empty or loaded cars around the yard.

Mention has been made of the fact that a locomotive crane is a multi-purpose machine. It is possible to operate every locomotive crane with either a hanging block, bucket, or magnet. Rigged with hanging block and slings a crane will handle practically all materials and products.

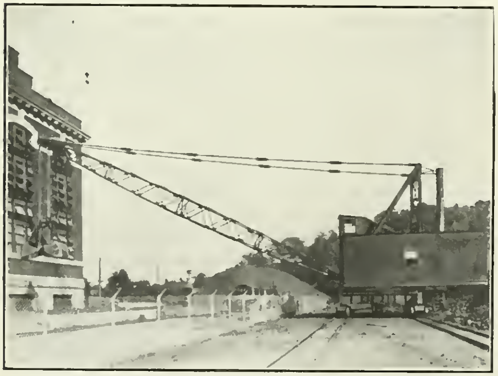

FIG. 8 A NON-ELEVATING BOOM IS SOMETIMES EMPLOYED

For intermittent handling of small parts and loose materials, a skip, or metal box, hung on the crane hook by chains, is ordinarily used. When loose materials in bulk are to be loaded or unloaded, the use of a clam-shell or orange-peel bucket cuts down costs. The bucket eliminates all hand labor except perhaps one or two men required for "cleaning up".

In ordinary plants, where the bucket is used only part of the time, the operator can run the crane and tend his own fire. In such places the crane is employed also for work requiring a hanging block rig. It is necessary to interchange this rig with the bucket attachment. Hence, work should be scheduled so as to reduce changes to a minimum.

Where quantities of pig or scrap iron, small structural shapes, steel tubes and small pipes, borings, and other iron products are involved, a magnet is used. Magnets save so much time and labor that even small plants find them economical as auxiliaries to the cranes. These magnets come in the following diameters: 36 in., 45 in., 55 in., and 65 in. Capacities range from about 200 lb. of loose sheet scrap to a 50,000 lb. billet, depending entirely on the nature of the material.

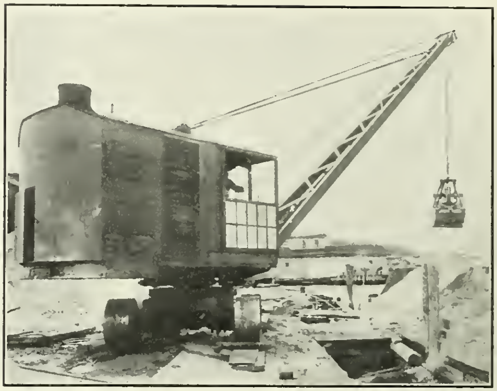

FIG. 9 TRACTOR CRANES RUN WELL ON SMOOTH ROADWAYS

The magnet is simply hung on the hook, the wiring connected with the source of power, and the crane is ready to operate without loss of time. If direct current power lines (220 volts) are located near where the crane is used, outlets can be installed every 50 ft. to connect with the magnet. In the absence of power lines, the crane is equipped, when built, with a direct current generator set of 5 or 7½ kw.

Use of Cranes Saves Labor

It has thus been shown that the locomotive crane is in every-day use in manufacturing industries at a great saving of time and labor. In this limited space it has been possible to point out only a few such uses. Many more are on record but could not be included. In every case the locomotive crane has proved superior for the type of service adopted, and has operated with a saving of anywhere from 5 to 50 men previously engaged in hand labor. In addition the actual operating costs of the crane, including all charges, have uniformly been lower than those involved in burden charges under the former hand labor methods.

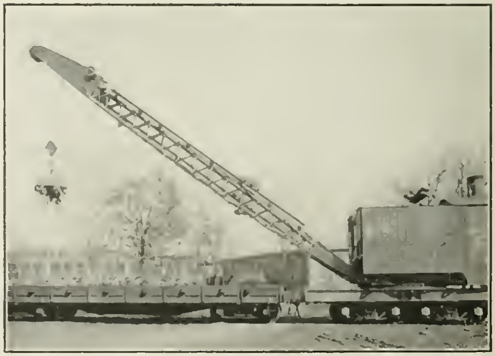

FIG. 10 THE MAGNET IS USED FOR HANDLING IRON AND STEEL

Finding Your Industry's Cycle

Industrial Budget Methods—II

By JOSEPH H. BARBER

Staff Assistant to the President, Walworth Manufacturing Company

Index Number	
658.14	Financial control
338.97	Industrial cycles

INDUSTRIAL budget forecasting points the way to dividends out of profits it helps to earn. For effective forecasting translates relevant general business trends into consequent trends for the individual industry, and it does so in quantitative terms.[1]

The purpose of the first article was to outline the field of opportunity forecasting offers for industrial budgets and the scope of its necessary activities. This article outlines the methods of quantitatively analyzing the particular cycles (of orders, of shipments, of collections, etc.) of the particular business; later articles will present procedures adopted for deriving the specific external barometers and their composite for comparison, the possibilities of determining, at least in a broad way, our present location in the current cycle of "General Business," and, finally, the translation of the forecasts into quantitative language for budgetary control.

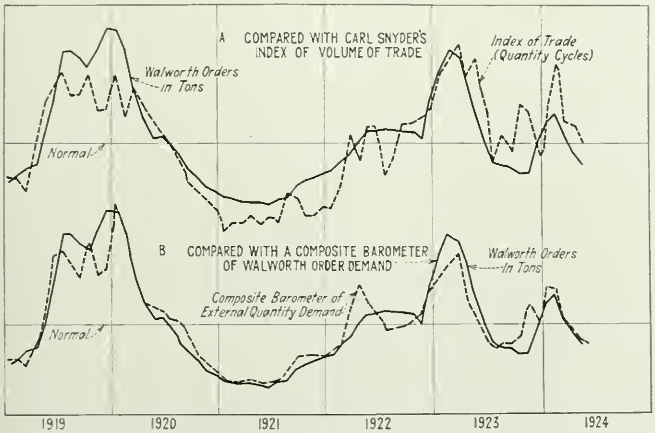

FIG. 8 ORDERS RECEIVED VERSUS RELEVANT INDICES OF VOLUME OF TRADE

Fig. 8 is again reproduced here to show a quantitative comparison of our post-war orders cycle, first with Mr. Snyder's Index of Trade and then with an average "Index of Trade" developed by ourselves. The comparison with Mr. Snyder's index alone did not give a sufficiently good fit, quantitatively. Therefore, we ascertained what other quantity barometers, reflecting causes of variation in our demand rates, might be averaged with the general barometer to indicate the cycles of our own order demand.

First, it is to be noted from the chart that quantity ordering began unquestionable declines after January 1920, March 1923, and February 1924. These turning points occurred not only a number of months prior to those recorded by our shipments (value) cycle, but for several months after the shipments cycle's real turning points, the initial shipments decline was so gradual and uncertain as to delay policy decisions which were urgently advisable. Moreover, in the 1922 recovery period this orders cycle very soon reached and passed above normal, although the shipments cycle based on value barely advanced to, and just hovered at, normal during the last half of 1922 only.

Second, it is further noted that the composite external barometer, which we have prepared for comparison with our own orders cycle, provides us with a specific means for checking up probabilities as to our own future cycle trend. It would be highly desirable to discover some external barometer cycle which would always predict our cycle. We have not been able to find it. Probably such an external cycle for us does not exist, for, it will be recalled, not only "manufacturers" but also "orders" are both classed as the very first to exhibit cycle changes.

Now *trends*, such as are shown in Fig. 8, are the only common ground of comparison between the external and the internal conditions. Hence, no industrial administrator can gage the extent of his industry's ups and downs, present or future, nor can he evaluate for the specific control of his complex industry the many forecasts of "general business," until he has revealed to himself his industry's *comparative* status. Nor, yet again, will the recorded experiences of the interdependent elements of his industry be fully regimented into disciplined alignment for inspection and approval until their raw material has been put through the paces for certain necessary "corrections".

For instance, Fig. 9 shows the actual record of orders received, for our total orders, and for the major sub-groups comprising the total. Contrasted with the "general business" indicators and forecasts available at that time the records are almost meaningless. If there appears no sensible coherence within the parts of our own order demand, how, then, could we expect to predict our average order demand from the vaguely worded forecasts of "general business"?

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[1] See MANAGEMENT AND ADMINISTRATION for October 1924, p. 371.

Fig. 10 accomplishes the first step toward intelligence in this direction. Each of the records of Fig. 9 has been "corrected," that is, divested of the effect of influences irrelevant for comparison, and at once there is noted the effect of some general influence depressing in common the total and *each* of the individual order rates. Since the charting is in ratio there becomes available the rule:

> General business trend influences cause group volumes to increase or decrease by the same percentage that they cause the total volume to increase or decrease.

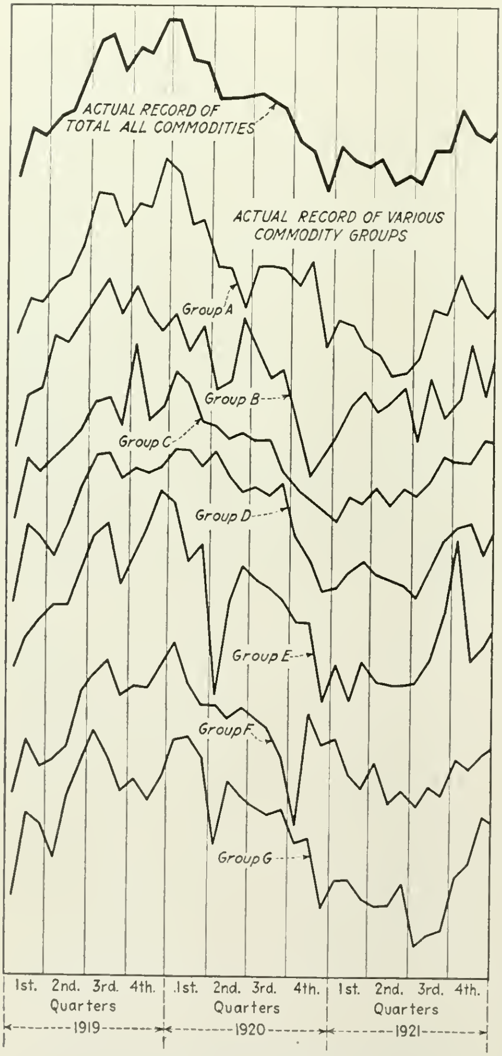

FIG. 9 ACTUAL RECORD OF TOTAL ORDERS RECEIVED AND RECORD OF COMMODITY GROUPS COMPRISING THE TOTAL

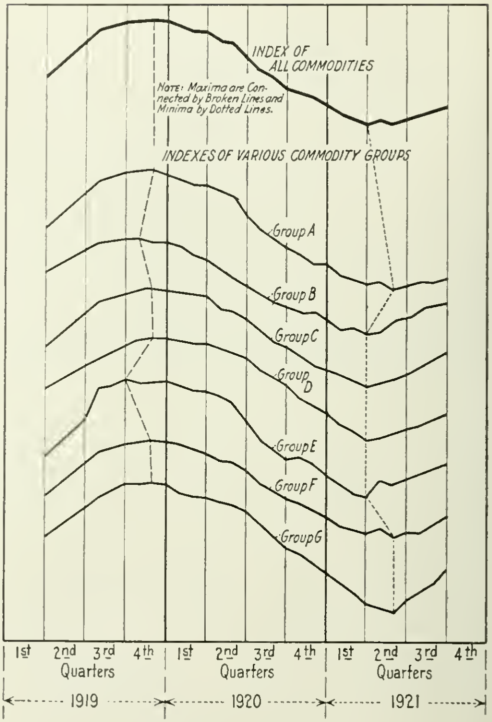

FIG. 10 CURVES OF FIG. 9 AFTER REMOVING IRRELEVANT FACTORS

Now a rule developed from the past, of itself, is devoid of value, for, as George E. Roberts, Vice-President of the National City Bank, has said:

> The very spirit of enterprise, at any given time, resides in the act of looking forward, in divining the trend of events, in foreseeing the probable movements of popular demand, in anticipating these, and in taking measures to provide for consumers such quantities and varieties of products as will have a ready market.[2]

Nevertheless, the rule stated does provide a tool for fashioning expectations and consequent policies, and this tool can prove very useful when it is possible to harmonize the currently available forecasts of general business. Harmony in these forecasts usually is evident when we properly interpret the language and intent of the several reputed forecasting organizations. The attempt to derive for the individual industry the net forecast of general business from the gross total of many current forecasts is quite definitely the obligation of the business statistician, and that problem will be approached in articles which will follow later.

No less than the same "spirit of enterprise" must impel these business statisticians forward, and Colonel

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[2] "Economic Progress," p. 1.

TABLE 3. ACTUAL SALES OF TYPICAL BRANCH[1]

	1919	1920	1921	1922	1923	1924
Jan..	$1,176	$1,729	$892	$801	$1,420	$1,475
Feb..	1,068	1,705	868	779	1,569	1,762
Mar	1,112	2,041	1,053	1,070	2,082	2,043
Apr.	1,333	1,644	857	1,134	1,995	2,105
May.	1,257	1,771	910	1,356	2,069	1,945
June..	1,279	1,861	962	1,331	2,253	1,844
July.	1,335	1,896	818	1,359	2,043	1,962
Aug	1,643	2,105	974	1,680	2,040	....
Sept	1,845	2,093	1,106	1,635	2,005	.....
Oct.	2,264	2,015	1,210	1,752	2,340	
Nov.	1,637	2,049	1,187	1,790	2,017	
Dec..	2,248	1,957	983	1,722	2,022	
Total....	$18,197	$22,866	$11,820	$16,409	$23,855	

[1] In nearest hundreds of dollars, thus insuring sufficient accuracy yet greatly facilitating manipulation.

Leonard P. Ayres, Vice-President of the Cleveland Trust Company, challenges them to their full task:

> The job of the business statistician is to look into the future. He is employed to furnish those in positions of top control in his firm with a fact-basis for their thinking and acting. . . .
>
> The successful business man is usually innocent of any thorough understanding . . . of the statistical technique by which the lessons of previous transactions may be interpreted. It is the business statistician who is called upon to bridge the gap between knowing and doing.[3]

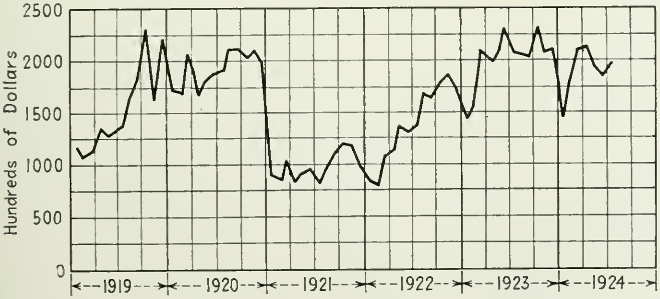

FIG. 11 ACTUAL MONTHLY SALES RECORD OF A TYPICAL BRANCH

This article will set forth, simply, some of this technique involved in "correcting" actual records to enable the business statistician to interpret the reactions of his own business and of its parts. First, a sample record of historical experience will be analyzed by the methods, and upon the standardized forms which we actually use, and then an example will be given to show how such knowledge enables true comparison of elements of the business.

The particular phase of experience selected for analysis will naturally depend somewhat upon the purpose for which the revelations are to be utilized, but more upon the availability in monthly form over a period of years of the figure series recording the experience to be analyzed. If it is desired to establish sales quotas or to anticipate collections of cash, monthly sales-billed records would yield valuable findings. For production control it would be helpful to have an estimate of future requirements based upon a projection of an orders received curve measured in customary quantity terms. For illustrative purposes, Table 3 tabulates and Fig. 11 charts the sales experience of a typical branch in our industry.

Revealing the Seasonal Variations

In the preceding article it was noted that in order to study the other fluctuations of a series of actual raw figures it is desirable to eliminate their seasonal variations; and that, for a test case, this correction is roughly accomplished in the continuous one year's moving average of the monthly sales figures because each average point results from an always maintained assortment of seasonally high months with seasonally low months to wash out seasonal differences.

Fig. 12 shows such a one year's moving average and the actual monthly record alternating about it. Such calculation is made in the first four columns of Table 4. Column A amounts are those of Table 3. From the sum of the first twelve months is to be derived the first annual average. This annual average will be really representative of only that particular twelve-month group. Therefore, the logical location for recording it is at the middle of that twelve-month period or between the sixth and seventh month.

After the first twelve-month total has been entered between June and July, a "Window card," cut to fit over columns A and B and marked as in Fig. 13, will be placed so that only the 1919 and 1920 Januarys will show through the two left-hand windows. The card's directions are then to be followed for each month prior to its "move" downward to the next month's position.

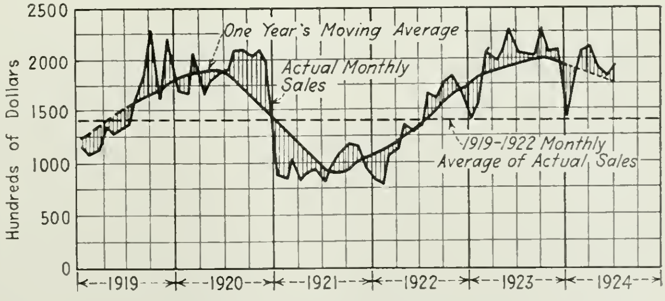

FIG. 12 ACTUAL MONTHLY SALES PLOTTED AGAINST ONE YEAR'S MOVING AVERAGE OF SALES

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[3] "The Nature and Status of Business Research," p. 1.

When column C averages are derived from column B totals, each of the two averages adjacent to any particular month are themselves averaged and entered in column D in order to give the "elevation level" of the year's moving average that exactly coincides in point of time with that particular month. For charting purposes only, this column D step would be unnecessary, but a later step necessitates accurate comparison of the level of each actual month with the elevation of the year's moving average at the same time.

TABLE 4. DEVIATIONS FROM MOVING AVERAGE[1]

Month	Actual Mo. Centered on 15	12 Months' Total Centered on 30	12 Months' Average Centered on 30	Corrected Centers of Moving Average	Deviation From Moving Average
	A	B	C	D	E
Jan. 15, 1919	1,176	....	....	(1,230)	95.6
Feb. 15	1,068	....	....	(1,300)	82.2
Mar. 15	1,112	....	....	(1,380)	80.6
Apr. 15	1,333	....	....	(1,430)	93.2
May 15	1,257	....	....	(1,470)	85.5
June 15	1,279			(1,500)	85.3
		18,197	1,516		
July 15	1,335			1,539	86.8
		18,750	1,562		
Aug. 15	1,643			1,589	103.4
		19,387	1,616		
Sept. 15	1,845			1,655	111.5
		20,316	1,693		
Oct. 15	2,264			1,706	132.7
		20,627	1,719		
Nov 15	1,637			1,740	94.1
		21,141	1,762		
Dec. 15	2,248			1,786	125.9
		21,723	1,810		
Jan. 15, 1920	1,729			1,834	94.3
		22,284	1,857		
Feb. 15	1,705			1,877	90.8
		22,746	1,896		
Mar 15	2,041			1,906	107.1
		22,994	1,916		
Apr. 15	1,644			1,906	86.3
		22,745	1,895		
May 15	1,771			1,913	92.6
		23,157	1,930		
June 15	1,861			1,918	97.0
		22,866	1,906		
July 15	1,896			1,871	101.3
		22,029	1,836		
Aug. 15	2,105			1,801	116.9
		21,192	1,766		
Sept. 15	2,093			1,725	121.3
		20,204	1,684		
Oct. 15	2,015			1,651	122.0
		19,417	1,618		
Nov. 15	2,049			1,582	129.5
		18,556	1,546		
Dec. 15	1,957			1,508	129.8
		17,657	1,471		
Etc.	Etc.	Etc.	Etc.	Etc.	Etc.

[1] Vertical spaces between months must be equal to use Window Card, Fig. 13

It is these column D values, however, which were plotted as the year's moving average of Fig. 12. Of course there are no actual column D values for the first six months of 1919, but observation of the alternations of the "actual" line about the moving average or trend line reveals not only that the actual develops areas under the trend line in the first six months of each year, but also that, when sales are low, these areas are greater than in years of high sales. This enables us to project backwards through the first half of 1919 the probable average trend of that period. These estimated values are then entered within parentheses at the top of column D in Table 4.

Correcting the Trend Line

Now for each month we have a comparison of actual with the "roughly corrected for seasonal" trend. Such comparison at once develops the fact that the moving average method of correction is indeed "rough". Annual seasonal habits develop areas first under, and then over, the trend line, but the areas obviously do not offset each other as they should, partially because the moving average never properly splits the seasonal areas at the peaks nor in the valleys. Moreover, aside from the fact that the roughly corrected line can never be posted down to date within six months, it is *too* smooth. The averaging has corrected out the seasonal influence in a rough manner, but it has also corrected out the erratic, unseasonal, intermediate movements which it is to our good purpose to retain in the record. Consequently, we wish to find indicators of that portion of the actual experience which may reflect the influence to be depended upon as seasonal only.

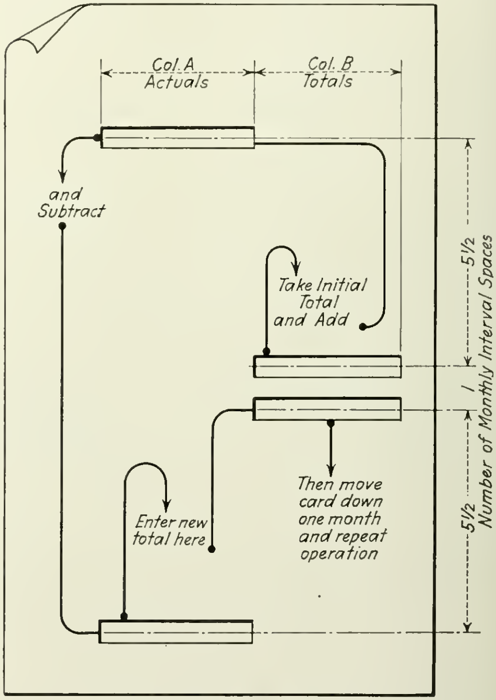

Col. A Actuals
Col. B Totals
and Subtract
Take Initial Total and Add
Enter new total here
Then move card down one month and repeat operation
5½
1
5½
Number of Monthly Interval Spaces

FIG. 13 WINDOW CARD FOR WORKING MOVING AVERAGE

If we assume that the moving average line records the true experience corrected only for seasonal and for unusual influences, then, as in Fig. 14, we may conceive of this corrected trend line stretched out until

TABLE 5. MEDIAN SELECTION FOR CONSTRUCTING SEASONAL INDEX

Month	Actual Deviations[1]					Total of Center Values	Average of Center Values	Final Seasonal Values
	1919	1920	1921	1922	1923			
	A	B	C	D	E	F	G	H
Jan......	(95.6)[2]	94.3	62.2[2]	73.8	78.7	246.8	82.3	83.3
Feb......	(82.2)	90.8[2]	65.0[2]	68.7	84.8	235.7	78.6	79.6
Mar......	(80.6)[2]	107.1	83.9	89.7	110.8[2]	280.7	93.6	94.9
Apr......	(93.2)	86.3	73.8[2]	91.8	104.0[2]	271.3	90.4	91.6
May......	(85.5)	92.6	82.3[2]	106.0[2]	105.9	284.0	94.6	95.8
June.....	(85.3)[2]	97.0	93.8	99.8	114.1[2]	290.6	96.9	98.0
July.....	86.8	101.3	84.1[2]	97.2	102.6[2]	285.3	95.1	96.2
Aug.....	103.4	116.9[2]	99.3[2]	115.5	102.0	320.9	107.0	108.1
Sept.....	111.5	121.3[2]	114.5	107.0	99.7[2]	333.0	111.0	112.0
Oct......	132.7[2]	122.0	123.3	109.3[2]	116.5	361.8	120.6	121.0
Nov.....	94.1[2]	129.5[2]	117.2	107.2	100.5	324.9	108.3	109.5
Dec......	125.9	129.8[2]	93.6[2]	99.1	101.7	326.7	108.9	110.0
						Totals	1,187.3	1,200.0

[1] From Table 4.

[2] Struck out in obtaining averages.

it is horizontal, still retaining below it and above it the areas of Fig. 12. But, of course, for year by year comparison of seasonal areas, peak year areas must be reduced and valley year areas expanded by throwing the actual records into percentages of the moving average trend line. This is done in column E of Table 4, for which the actual figures of column A are divided by the same month's values in column D, deriving the percentage variations for charting Fig. 14.

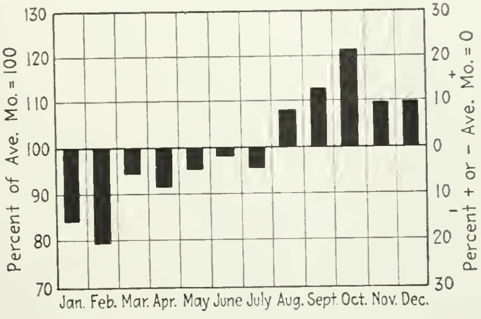


FIG. 16 SEASONAL VARIATIONS SHOWN ON PERCENTAGE OF THE AVERAGE MONTH OF THE YEAR

Here we see, however, that the contour of the areas in each year are varied by erratic and unusual influences, and that defects of the moving average in a year like 1921 cause below-the-line areas to out-balance above-the-line areas. Nevertheless, we are approaching an answer to the questions: "Can we always count on February being below January?" and, "Are both of them always somewhat less than the average month of the year?"

It is helpful to regroup the evidences of Fig. 14 so that in Table 5 and in Fig. 15 we may study, separately, each month's characteristics. In Fig. 15 the presence of constant seasonal influences is confirmed if, as is the case, at least four out of five of each month's circles are clustered on the same side of the 100 line (or are definitely clustered at the 100 line) and if the eye must noticeably dip or rise in passing from the cluster of one month's circles to those of adjacent months. If a natural monthly clustering is not apparent in view of the general "scatter" of all the circles, then probably month-by-month variations are purely erratic, with no actual evidence of dependable seasonal influence.

Constructing an Index of Seasonal Variations

If seasonal influences do seem to exist, we may construct a reliable index of the average seasonal varia-

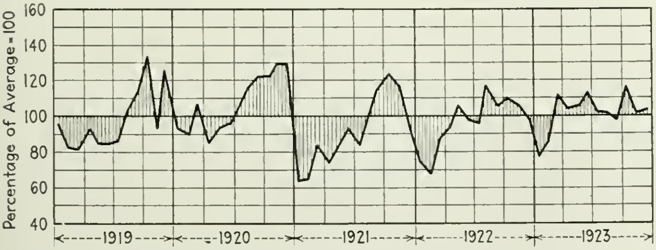


FIG. 14 MONTHLY ACTUAL SALES SHOWN AS PERCENTAGE OF ONE YEAR'S MOVING AVERAGE OF SALES

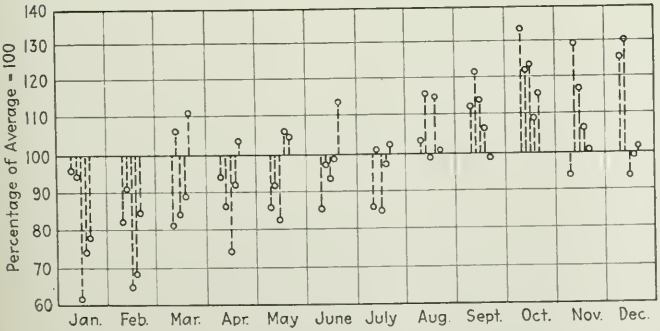


FIG. 15 MONTHLY EXPERIENCE OF DEVIATIONS OF ACTUAL SALES FROM ONE YEAR'S MOVING AVERAGE OF SALES

tion, providing we have, as in Table 5, at least 60 months entries and, in any case, entries in some multiple of 12. We assume that any month's erratic experiences are those which tend away from the natural cluster and, therefore, in Table 5, we strike out the two extreme experiences when obtaining an average experience for that month—a column G average—which tends to eliminate any inherent statistical errors. The 12 indexes are adjusted in column H so as to total exactly 1200, or 12 times the average month of the year as 100 per cent.

These average indexes are charted in Fig. 16 and they indicate, first, the typical seasonal movement which would alone be in evidence if there were a non-erratic average year and, second, the extent to which each month of such a year would run above or below its average month.[4]

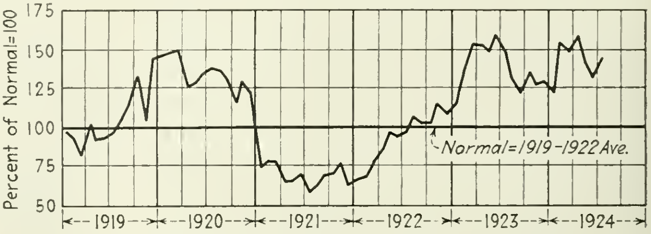


FIG. 17 CORRECTED SALES SHOWN AS A PERCENTAGE OF NORMAL

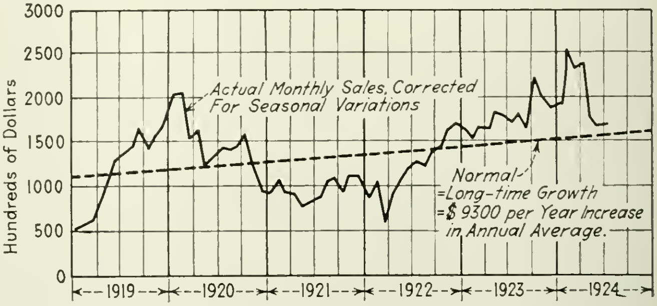


FIG. 18 CORRECTED SALES OF ANOTHER BRANCH AND ITS CALCULATED LONG-TIME GROWTH

Correcting Out the Seasonal Variations

To analyze the business cycle and unusual experiences divested of the confusion injected by seasonal variations, we must correct the seasonal out of the Table 3 records. This is begun in columns A and B in Table 6 by dividing the actual record for a calendar month by the seasonal index for that month to secure the corrected figures of column C. This correction is based upon the assumption, first, that at least the average augmentive or restrictive seasonal influence is effective in each year's experience to the average degree or percentage, and, second, that the effect of this *known* and measured influence must be allowed for prior to other adjustments based upon *assumptions*.

TABLE 6. CORRECTED CYCLE TREND INDEX

MONTH	ACTUAL	SEASONAL INDEXES	ACTUAL CORRECTED	NORMAL LEVEL	CYCLE PER CENT OF NORMAL
	A	B	C	D	E
1919					
Jan	1,176	83.3	1,412	1,443	98
Feb	1,068	79.6	1,342	1,443	93
Mar...	1,112	94.9	1,172	1,443	81
Apr.	1,333	91.6	1,455	1,443	101
May	1,257	95.8	1,312	1,443	91
June.	1,279	98.0	1,305	1,443	91
July...	1,335	96.2	1,388	1,443	96
Aug..	1,643	108.1	1,520	1,443	105
Sept	1,845	112.0	1,647	1,443	114
Oct..	2,264	121.0	1,871	1,443	130
Nov..	1,637	109.5	1,495	1,443	104
Dec..	2,248	110.0	2,044	1,443	142
1920					
Jan.	1,729	83.3	2,076	1,443	144
Feb.	1,705	79.6	2,142	1,443	148
Mar	2,041	94.9	2,151	1,443	149
Apr	1,644	91.6	1,795	1,443	125
May	1,771	95.8	1,849	1,443	128
June	1,861	98.0	1,899	1,443	132
July.	1,896	96.2	1,971	1,443	137
Aug	2,105	108.1	1,947	1,443	135
Sept.	2,093	112.0	1,869	1,443	130
Oct	2,015	121.0	1,665	1,443	115
Nov.	2,049	109.5	1,871	1,443	130
Dec	1,957	110.0	1,779	1,443	123
Etc.	Etc.	Etc.	Etc.	Etc.	Etc.

The Completed Cycle Index

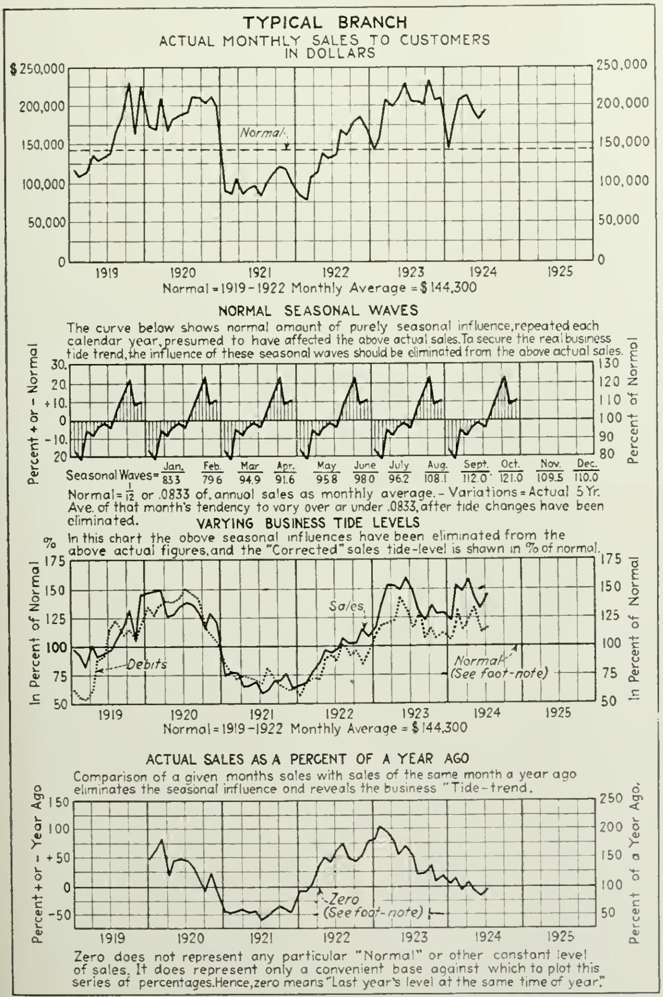
The corrected trend completed in column C would show a smooth sales cycle, but the greatest value of a fuller analysis will be the ability to compare this particular record of fluctuations against others related in the same or any allied industries. As emphasized in the preceding article, such comparison involves standardized terms and units of measurement. For most helpful comparison, dollar figures are not fully suitable, being affected by price changes, yet any two records, such as they are, may be fairly compared upon a common denominator basis if each is expressed in the form of index numbers.

Index numbers, however, necessitate some 100 per cent base line, or "normal"—an assumption of some level or experience which is never for long the actual experience. If all fluctuations could be controlled, that is, if we could continually maintain no more or no less than normal activity, this normal would, of course, be an average of all above-normal and below-normal experiences. For such a normal, we have been assuming that a straight monthly average of the years 1919 to 1922, would be a fair base for the short post-war period and for the next year or two. In most series we have examined, these 48 months included a fairly representative assortment of the varying months.

---

[4] We feel that the Macaulay or federal reserve seasonal method described operates best in our widely fluctuating series over a limited number of years. One other method in equally good standing, the Persons link-relative method, is fully described in a pamphlet to be referred to later. The Persons method is simpler and less involved, yet it seems to depend for accuracy on either more moderate fluctuations or a much longer span of years.

The normal level represented by the 1919-1922 average for our typical sales experience is shown in Fig. 12 and is entered at the head of column D, Table 6. Successively, column C amounts are divided by this column D normal, thus deriving the column E series of "corrected" cycle index numbers for charting the cycle shown in Fig. 17.[5]


TYPICAL BRANCH
ACTUAL MONTHLY SALES TO CUSTOMERS IN DOLLARS

Normal = 1919-1922 Monthly Average = $144,300

NORMAL SEASONAL WAVES
The curve below shows normal amount of purely seasonal influence, repeated each calendar year, presumed to have affected the above actual sales. To secure the real business tide trend, the influence of these seasonal waves should be eliminated from the above actual sales.
Percent + or - Normal
30.
20.
+10.
0
-10.
20
130
120
110
100
90
80
Percent of Normal
Seasonal Waves = Jan. 83.3 Feb. 79.6 Mar 94.9 Apr. 91.6 May 95.8 June 98.0 July 96.2 Aug. 108.1 Sept. 112.0 Oct. 121.0 Nov. 109.5 Dec. 110.0
Normal = $\frac{1}{12}$ or .0833 of annual sales as monthly average. – Variations = Actual 5 Yr. Ave. of that month's tendency to vary over or under .0833, after tide changes have been eliminated.

VARYING BUSINESS TIDE LEVELS
In this chart the above seasonal influences have been eliminated from the above actual figures, and the "Corrected" sales tide-level is shown in % of normal.

Normal = 1919-1922 Monthly Average = $144,300

ACTUAL SALES AS A PERCENT OF A YEAR AGO
Comparison of a given months sales with sales of the same month a year ago eliminates the seasonal influence and reveals the business "Tide-trend.

Zero does not represent any particular "Normal" or other constant level of sales. It does represent only a convenient base against which to plot this series of percentages. Hence, zero means "Last year's level at the same time of year."

FIG. 19 ACTUAL MONTHLY SALES OF A TYPICAL BRANCH

Assuming a constant normal level, this, in some cases, would not develop a cycle index chart where the areas above and below normal would approximately counterbalance each other. Even in the illustrative case shown, the existence of a "long-time growth" influence is suggested by 1923 peak months generally higher than the 1920 peak months, and a 1924 hesitancy to approach levels even as low as in 1921.

From some experience records a real picture of the above-normal and below-normal cycles cannot be revealed unless the corrected sales be measured as a percentage of a constantly increasing normal level, graphically pictured as a sloping line. In the case of the experience of one of our units, charted in Fig. 18, the corrected sales line would not present offsetting areas unless the normal were calculated and assumed to be in existence as shown.

The method of calculating the slope of the constantly changing normal level cannot ordinarily be applied to so short an experience, but it may be utilized in cases where the long-time growth influence is considerable and persistent. This is another one of the Persons methods simply but adequately described (together with his other methods developed for the type of analysis we are describing) in the pamphlet entitled "Comparison of an Individual Concern with the Harvard Index of General Business Conditions".[6]

Comparison With External Business

Probably the best single indicator of general business in any branch territory is the "debits to individual accounts" in the principal cities of the territory. For comparison, the debits must be corrected for *their* seasonal variations and shown as an index of *their* normal (sloping if necessary, but otherwise an average of the same base period of years).

For its suggestive value we show in Fig. 19 our complete standardized forecasting chart filled in with the curves of the particular illustrative series used here. In comparison with the Fig. 17 cycle curve, here reproduced in the third section of the complete standard chart, we have the debits cycle for the same territory. There is a fair degree of correspondence between the two cycles, the sales reflecting well the various changes in the debits cycle. However, due to greater long-time growth influences, which in this case have not been corrected out, our sales curve is running higher than the debits curve by an increasing margin.

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[5] To a clerk familiar with the processes, and having at hand the data to compile the post-war series as in Table 3, all the calculations described herein and the necessary sketch charts can be completed and checked in less than 12 hours.

[6] Published early in 1924 by the Harvard Economic Service, Cambridge, Massachusetts.

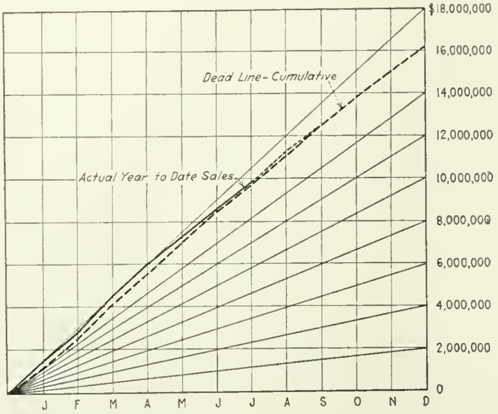

FIG. 20 TOTAL CUSTOMERS' SALES. ACTUAL VS. DEAD LINE

It is such comparison which enables forecasting. The sales curve may be compared with other territorial indicators, or a composite cycle curve for the territory's general business may be evolved out of the data in the files of any of the commercial statistical organizations. Economic analysis then lays the foundation for a reasonably accurate future projection of the home-made general cycle indicator in order to estimate the probable consequent reaction of the particular cycle. The monthly levels of the predicted sales cycle trend translated into dollars, and multiplied by seasonal indexes give the actual forecast of sales.

In December 1923, possessing such individual cycle curves, each developed from a unit's own experience and projected through 1924 on the basis of probable economic conditions in its own territory, we were able to construct a sales quota mark for each sales unit for each month of 1924. That the basis of analysis was sufficiently sound to make possible a good forecast is brought out in Fig. 20, in which the cumulative actual experience is compared with the cumulative Dead Line (the "must" requirement of our dual quota plan).[7] The probable year-to-date actual curve for August and September has been drawn in on the basis of sales accurately estimated for the monthly financial budget.

The inter-unit comparison upon a just basis is accomplished by measuring each unit's actual performance in percentage of its own predetermined dead line requirement. Fig. 21 shows such comparison on a year-to-date basis from the latest actual record. In the chart, the unit failing to perform up to expectations compels attention; consequent investigation discloses reasons why the unit's sales have been disappointing and assures timely remedies.

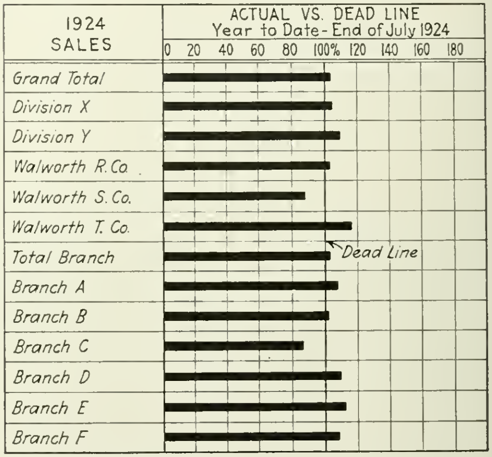

FIG. 21 PERFORMANCE COMPARISON AGAINST FORECAST SALES

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[7] See full description in *Administration*, June and July 1923.

Preventing Accidents on the Plant Elevator

WHERE the opportunities for taking chances are particularly inviting, the safeguarding of the worker must go beyond providing him with ordinary safety appliances. R. B. Poague, superintendent of plants of the American Brake Shoe and Foundry Company, states:

"The one big chance which our employees seemed determined to take was with freight elevators. Despite injuries, deaths, and all manner of warnings and regulations laid down by the management, they insisted on being careless. They made flying jumps into the cars after they started up—and got caught between the rising floor and the wall of the shaft. They jumped out of the cars before they had come to a standstill—and injured themselves by stumbling. Ordinary elevator gates did no good. Elevator men or workers in a hurry opened these gates at exactly the right time for someone to make a rush for the car and get hurt.

"Finally we installed gates which positively could not be opened or closed except when the car was standing still on a level with a floor. These were also connected with devices which prevented the elevator from moving away from the floor until the gate was closed. Thus the jumping on and jumping off evils were stopped, elevator accidents came to a virtual termination, and our casualty insurance rates were decreased.

"While there are patented gates of the kind described on the market, the ones we installed were of our own design. They are of the type that lift up. The construction is so light that should any derangement of the hoisting apparatus halt the car unavoidably between floors they can easily be broken through to let the passengers safely out until the car is fixed and put back into service again."

Analysis of Salesmen's Quotas

Equitable Determination and Visualizing Results

By ARTHUR R. BURNET

Consultant in Business Statistics

SOME of the best-known concerns of this country, which pride themselves on their up-to-date methods, have experimented with the so-called Progressive Quota, and have now proved to their own satisfaction that both salesman and sales manager are satisfied with the form of record featuring the Progressive Quota, and that by its help they have been better able to meet the radically changed sales conditions following the war.

We all know that selling is not what it used to be. Enlarged productive capacity, increased competition, the switch to a buyer's market, and the pronounced tendency to shift the inventory load to the producer's shoulders have compelled sales managers to become sales strategists. Today you cannot simply give admonition and good advice to your men and send them out. Back of successful campaigns must be intensive market analysis, definite objectives, and proper training and preparation.

In a sales campaign the objectives are the quotas set up in advance for the individual salesman, for the company as a whole, for a territory, or for a product. It is recognized that the quotas must be attainable with reasonable effort, they must be set not arbitrarily but with regard for past achievement. The necessity for the right kind of quotas largely accounts for the vital matter that the measurement of sales has become.

Anyone at all familiar with sales management will agree at once that the most common method of measuring branch sales, or the sales of individual salesmen, or products, can be fairly represented, as in Fig. 1. If the record is purely numerical, the number of dollars or units are set down opposite the names, and the period of time is some convenient interval, such as a week, a month, a year, or the elapsed time since the beginning of the year, known variously as the "cumulative," or the "amount to date," etc. If the record is graphic, the bars are made proportional to the numerical quantities.

Whether we look at the figures or at the chart, we have no difficulty in seeing that Jones leads, that Smith trails, and that the others fall in between. On the face of the record, Jones wins the plaudits and Smith the punishment, and as for the rest, they are "also rans". The monetary rewards are often distributed in the same proportion. This is an exaggerated case, to be sure, and has been made so for the sake of emphasis, but the statement still holds that in the show-down the salesman or the branch, or the department that comes across with results that excel in bigness or size, are the ones most likely to get the credit. This is true whether applied to sales or production, or, in reverse order, to expense or losses. The fellow who delivers the goods—in quantity—takes the prize.

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It is perfectly natural to make absolute comparisons of this kind, but it may not always be just and fair. Suppose Smith is a new man, and has had less knowledge of the product or acquaintance with the field than the others. Maybe Jones' territory is larger or has a denser population, and perhaps Brown, Williams, and Clark carry different lines of goods or call on different classes of trade. There are a score of modifying circumstances, each of which would be sufficient in itself to account for variations in the results, if it were possible to assume equal sales ability on the part of the men.

But you say that all these modifying factors are known to the management, are reckoned on, and compensated for. Yes, in the mind and memory of a merciful sales manager they may be, but in the cold figures of the written record they are not. The problem is: How can we bring the numerical facts and the mitigating circumstances into the same picture? Or, better still: How can a comparative statement be presented that will be absolutely fair to all concerned, and at the same time be a simple statement, drawn up in terms already familiar to the management, and not in terms altered beyond recognition? That is the problem to which we address ourselves.

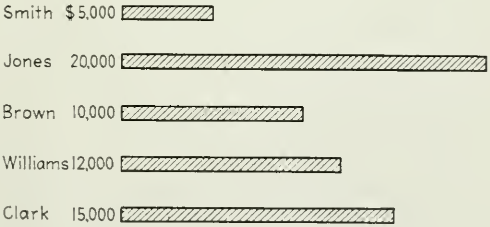
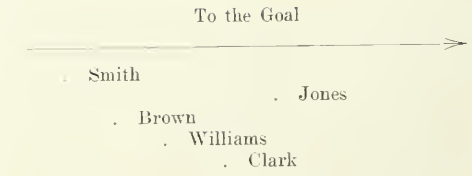


Fig. 1 Bar Chart Applied to Individual Sales

Let us think, for a moment, of Smith, Jones, and the others as if they were in a race, for as a matter of fact they are in a race, each under his own handicap. Here they are running towards the goal:



Poor Smith is unmistakably behind, but for all that we know he may be going at a faster *speed* than Brown, Williams, and Clark, or even Jones. If Smith is going strong enough and keeps up, he will outstrip the field. To be sure, he is not ahead yet, but why should he not be rewarded for the progress he is making in his own territory, under the peculiar and unavoidable conditions to which he is subjected? To compare these five at a given instant—the end of a month, or a year—is static, and it leaves out the vital element of speed, or rate, or, as we prefer to call it, progress. The fairest comparison is, after all, not an absolute comparison but a relative one, since, as we saw above, there are insurmountable differences in products, territories, and trades.

A notable attempt toward making comparisons thoroughly relative, and therefore just and fair, is the setting up of a fixed quota, and then recording the progress made towards reaching it in the form of percentages. This method is sometimes expressed in charts similar to Fig. 2.

This alters the picture completely. Here is information we did not have before. The dark horse, Clark, exceeded his quota, and Smith has not done so badly after all. This gives a relative comparison, sure enough, and is a vast improvement over the line-up in dollars or in product units. It is a form that has wide acceptance. Sometimes it is drawn on a monthly basis so that, for example, Clark has an excess to his credit that he can carry over into the next month, and Brown, and perhaps the others, have a chance of making up their deficits. This so-called progress chart was used with great effectiveness during the war in scheduling production and other operations.

The measurement of progress toward a fixed quota has certain distinct advantages, and goes a long way toward the solution of our problem, but there is still a serious obstacle in the way. How shall we fix the 100 per cent quota so as to satisfy everybody concerned? If a bonus hangs on the attainment of a quota, the salesman naturally wants the quota low, while the management, as a spur to greater attainment, is for setting the mark high. More than one salesman has thrown up his job in disgust, because the quota set was, to him, manifestly unattainable. The branch office complains that headquarters does not understand field conditions, and headquarters retorts that the branch office lacks "pep" and aggressiveness. "The business is there, why don't you go out and get it?" The weakness of the fixed quota is that, at best, it must be arbitrary. Because it cannot be put on an automatic, impersonal basis, it is frequently the cause of much bickering and the source of no little ill-will.

The source of the difficulty is in the fixed and arbitrary quota. If it could be made movable and automatic our problem would be solved. And this requirement is just exactly what we find in the Progressive Quota. Under the Progressive Quota idea, the *rate of increase* (or decrease) of sales for the whole company becomes the quota for each branch or for each salesman. Is it not eminently fair to expect all branches and all salesmen to have a *rate* of increase in sales equal to the *rate* of increase of the whole company? To expect this much, it may be readily seen, is neither arbitrary nor fixed. Changing circumstances making for easier or tighter business, will be registered in the rate of increase of the total sales of the company and so in the quota itself.

A still further adaptation of the Progressive Quota to fit the individual case, lies in the fact that in determining the salesman's rate of increase, the salesman's own past record must be used as a base. For him, the quota is not something taken out of the air. As he reaches out for new records he has one foot on his past attainments, achieved under the peculiar and individual conditions that surround his own field, or line of goods, or his own personal make-up. To come up to the Progressive Quota, then, the salesman needs to have a rate of increase over his own past record equal to the rate of increase in sales of the whole company over its past record. The salesman not only knows what his quota is, but how it is determined, and he has faith in its attainability because the quota is constantly being attained and surpassed. Could anything be more just?

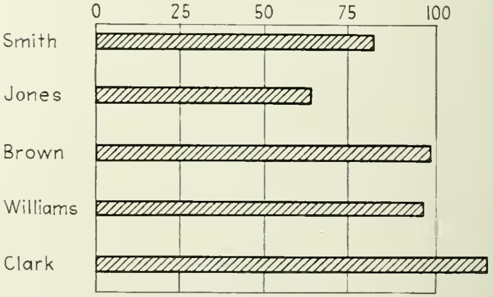


Fig. 2 Individual Sales Represented as Percentage of Quota

Under the Progressive Quota, the part is compared with the whole, instead of with the other parts, because in the record of the whole the individual advantages or disadvantages have counteracted each other, and the special, modifying, or mitigating circumstances have disappeared. For example, the rate of increase in the sales of Jones is compared with the rate of increase in the sales of the whole company, instead of with the rate of increase of Smith's sales, and thus bitter feelings against individuals are eliminated.

During the war it was observed by leaders of community music that crowds kept in tune. Individual singers might be off-key, but crowds, never. The adage: "There is safety in numbers," is old stuff, but still good. Statisticians have found that larger numbers move more slowly and steadily than small numbers; that they are subject to less violent fluctuations. Applied to selling, there is no incentive like the incentive of keeping up with the bunch or getting ahead of it. It's the spirit of the game: "What the other fellows do, I can do—let them set the pace. Exceptional individuals may, of course, outdistance me, but I'll certainly stay in the van, and then some."

The Progressive Quota can be expressed in percentages or by means of index numbers; for example, total sales during a given period have increased 10 per cent. The quota, then, for this period is an increase of 10 per cent. All branches or salesmen whose increase is greater than 10 per cent are exceeding their quota, and those whose percentages are lower are falling behind. The graphic presentation of the Progressive Quota is simplicity itself, and in every-day practice the facts of the record can be taken in at a glance. Fig. 3 shows four trend charts designed for the part-with-the-whole comparison which constitutes the Progressive Quota.

It takes but a glance at the charts to tell that total sales are increasing, that the sales of salesman "A" are increasing faster than the total; those of "B" at about the same rate as the total; while "C" is falling behind. In other words, "A" is exceeding the quota, "B" equaling it, and "C" failing to reach it.

These charts are very simple. It is no more difficult to read these charts than it is to watch a semaphore signal on the railroad, or the pointer of a steam gage. The scale figures have been purposely omitted, first, because they are unnecessary, since the actual values are given at the top of the charts, and second, to emphasize the fact that the slopes of the curves are to be read not merely in each individual chart by itself but in comparison with the slope of the total curve.[1]

Value of Trend Line

Two things should be made very clear about the design of these charts. The first is that the curves

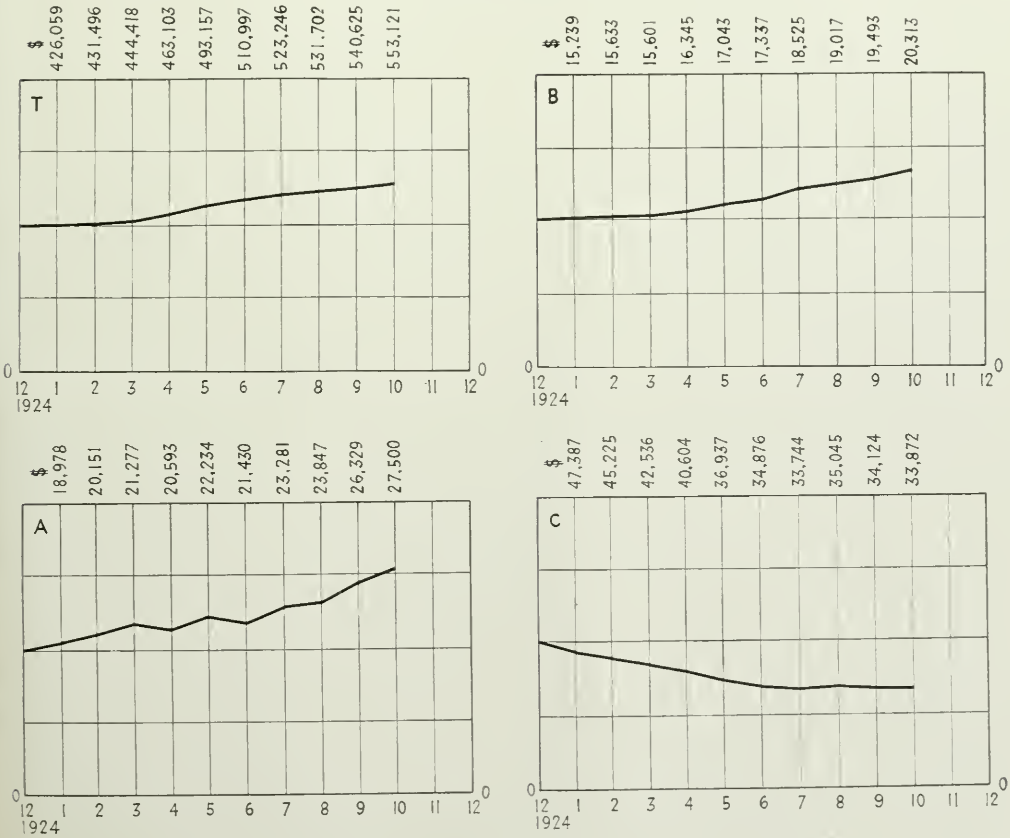


FIG. 3 THE PROGRESSIVE QUOTA ILLUSTRATED BY FOUR COMPARABLE TREND CHARTS

are trends, plotted monthly, the numerical values being the successive annual totals, or in other words, the total of the past 12 months as computed for each month. The trend line has distinct advantages in that it entirely eliminates seasonal fluctuations; it minimizes temporary and accidental variations caused by short months, distribution of holidays, illness, exigencies of bookkeeping, etc.

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[1] Construction of charts of this nature was described in "Comparability of Executive Control Charts," by Mr. Burnet, *Management Engineering*, November 1921, v. 1, no. 5, pp. 283-288.

And yet these advantages are not obtained at the expense of disguising the figures, which, the managing executive will at once recognize, are identical with the ones that appear in his operating reports and other regular statements. Because of the very nature of the trend, it gives the familiar "corresponding-month-last-year" comparison in this way: whenever the trend rises or increases its upward slope, it means that the month this year is larger than the same month last year, and whenever the trend falls, the reverse is true. Consequently, the trend gives a very complete picture. It is really an index of the subject to which it is applied, and for that reason, is a far safer guide than the current monthly record. Like the part-with-the-whole comparison, the trend curve in itself has eliminated special and mitigating circumstances, because each month it is giving the record for a whole year past instead of merely the current month.

Charts Scientifically Comparable

The second highly important thing that should be made clear about these charts is that they are plotted in such a way as to be scientifically comparable. It will be noticed that all the curves—the total as well as the salesmen—start out at the same distance from the zero line at the bottom. The starting point is located in the middle horizontal ruling which automatically becomes a line of reference, and thereafter visually represents the total for the preceding year, or whatever is chosen for the base period. Therefore, a given vertical distance on one chart represents the same percentage change on all charts. Likewise, a given slant of the curves on one chart represents the same percentage change on the others. This accounts for the slogan: "The slope of the line tells the story." All the charts have been reduced to the same focus, so to speak. In this respect the charts are like those plotted from index numbers which always have the base 100, but they differ from such charts in one highly significant particular. They are not plotted from index numbers, percentages are not at any time computed, and the data used and shown are not relative numbers, but the absolute data taken from the company records, and familiar to the executives as yearly totals. Executives do not have to readjust their minds in using these charts, or in passing from subject to subject. Comparable trend charts are virtually operating reports and instruments, and are so used.

Although primarily intended for officials in charge of sales, the Progressive Quota expressed in the form of trend charts works very effectively with salesmen. The men do not have to wait until the end of the year to find out how they stand on an annual basis. The practice is to supply each salesman with two charts every month—one representing company sales, or the sales of the branch to which he is attached, and the other representing his own sales. The latter chart carries the actual data, for he has access to that information anyway.

Comparison of Charts Shows Salesman Where He Stands

On the other hand, the company chart does not show data, and therefore the salesman has no way of finding out what the company figures are. A comparison of the two charts, however, instantly shows him where he stands; if he is ahead, how great a lead he has, and if he is behind, how far he must go to catch up. The beauty of it is that this comparison is expressed in terms of his own past accomplishment with which he is well acquainted. He can determine for himself, either as a percentage or in actual dollars, how much more business he must do to catch up with the quota as shown by the latest record given him. Since the curves on trend charts are not subject to violent fluctuations, it is even possible for the salesman to forecast with surprising accuracy where his own and company sales are likely to come out at the end of the year. And all this is accomplished without divulging company information.

There have been many instances in which the trend chart and the Progressive Quota have proved to be fairer and better representations of the actual facts, and also have provided incentive for increased sales accomplishment.

A well-known tire manufacturing concern had been basing its sales quotas on "car population" on the number of cars registered in a district. During a sales convention the manager of a western district came to the home office. His quota, covering a whole state, was practically identical with the quota for one of the large cities in the east. When asked why he could not make a better showing in comparison with the eastern city he said that he had a much greater area to cover and conditions were radically different. When the results were plotted in the form of trend charts, bringing the Progressive quota into play, it was found that the sales of the western branch were increasing faster than the total sales of the company, and faster than the eastern branch, and the rate of expense increase was less than the sales increase.

The sales manager of a New York concern uses trend charts and the Progressive quota to show to branch salesmen their position in relation to the company as a whole. By this method no company data is revealed to the individual salesmen but the comparisons between their sales and the company totals are perfectly clear and unmistakable.

A large concern that distributes nationally through its own sales force uses trend charts at its annual sales conventions to set before the men in a comprehensive way the entire sales situation. In a large bulletin board trend charts analyzing sales both by territory and product were displayed. By this method it was possible to tell at a glance how sales of different products and sales of any territory compared with the total sales.

Setting Sales Quotas

Working Plans for Profits—II

By G. CHARTER HARRISON

Consultant in Management

Index Number
658.808 Sales analysis

SOME years ago the writer received a call from a manufacturer whose business, once exceedingly profitable, had reached a point where the profits had practically vanished.[1] Due to increasing competition the volume of sales had been steadily falling until it fluctuated around the $4,000,000 mark, whereas the manufacturing facilities were sufficient to take care of a sales volume of $8,000,000.

The executives of the company had gone into conference over the situation, and upon the assurance of the sales manager that any further decline in the sales could be avoided, and the volume held at the $4,000,000 mark, it was suggested that the business should be organized on the basis of $4,000,000 of sales, and its expenses reduced to the minimum consistent with this volume. My opinion of this policy was asked.

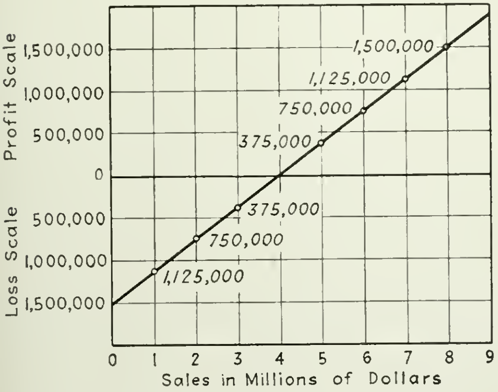

FIG. 3 EFFECT OF FIXED CHARGES ON PROFITS

The business was one which required the maintenance of expensive branch houses, and a careful investigation disclosed the fact that the fixed charges, including the factory and the selling and administration ends, could not be reduced much below $1,500,000 per annum. Further, the direct manufacturing and selling costs represented approximately 62½ per cent of the sales. Under these circumstances it was obvious that it was highly inadvisable to adopt the $4,000,000 program, because costs and sales would balance thus:

Sales		$4,000,000
Fixed charges	$1,500,000	
Fluctuating charges 62.5% of $4,000,000	2,500,000	4,000,000

The following statement showed the profits and losses which might be anticipated at different sales volumes up to $8,000,000. Fig. 3 shows this same statement plotted in graphic form.

SALES	MANUFACTURING AND SELLING COSTS		TOTAL	PROFIT	LOSS
	Fixed Charges	Fluctuating Charges			
....	$1,500,000	....	$1,500,000	....	$1,500,000
$1,000,000	1,500,000	$625,000	2,125,000	. .	1,125,000
2,000,000	1,500,000	1,250,000	2,750,000	. . .	750,000
3,000,000	1,500,000	1,875,000	3,375,000	. . . . .	375,000
4,000,000	1,500,000	2,500,000	4,000,000	....	....
5,000,000	1,500,000	3,125,000	4,625,000	$375,000	....
6,000,000	1,500,000	3,750,000	5,250,000	750,000	....
7,000,000	1,500,000	4,375,000	5,875,000	1,125,000	.
8,000,000	1,500,000	5,000,000	6,500,000	1,500,000	.

Needless to state, after considering this statement the $4,000,000 sales policy was promptly abandoned and attention directed to devising plans and means for increasing the sales volume. An exhaustive analysis of the market for the product manufactured by the company disclosed the fact that, taking the sales of the branch selling the greatest volume of goods in proportion to the sales possibilities of the territory as 100 per cent, the relative selling efficiency of the other branches ranged to as low as 29 per cent, and that the branches as a whole averaged only 50 per cent of the sales which would have been realized had they all been operating as efficiently as the branch taken as 100 per cent. The major problem of earning maximum profits for that company therefore resolved itself into one of organizing its sales branches so that they would all sell as large a volume of goods in relation to the possibilities of their territory as the best branch had shown to be possible.

The situation just cited is a good illustration of what can happen to a business which is allowed to drift along without any definite objectives. One of the most important things any manufacturer can do is to sit down and figure what the real possibilities of profits from his business are, and then make his plans to realize as nearly as possible the full profit-making capacity of the business. Let him get his factory manager, his sales manager, and his accountant together, and have them figure what the factory could produce if it were operating continuously at full capacity, and what the profits would be from the sale of this product. Then let them figure what the profits would be if the factory were able to operate only at half capacity, and also what the profits would be if the factory ran double shifts. The lesson learned from this procedure will be of incalculable value, for, strange as it may appear, the average sales manager does not realize the tremendous effect of volume of sales on profits. He knows in a general way, of course, that the net profits represent a greater per cent of sales when the sales are large than when they are small, but the full effect of decreased sales volume he does not appreciate. The tremendous reduction in the profits in proportion to the sales is illustrated by the curve shown in Fig. 4, which is based upon the statement used in making up the chart shown in Fig. 3.

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[1] See MANAGEMENT AND ADMINISTRATION for October 1924, p. 361.

A Sales Manager's Mistake

Some time ago the sales manager of a large concern during a period of partial business depression, made a great discovery, or at least he thought that he had. He found out that a certain product made by his company could be purchased considerably under the cost of making this product as shown by the cost records, and he prevailed upon the company to purchase this item from the outside instead of having it manufactured in the company's own factory. He made what seemed on the surface to be a saving of $20,000, but he did not realize that as a result of the loss of production resulting from this outside purchase, the costs of the other products were increased $100,000. If he had had before him a profit and loss curve for his business like that shown in Fig. 4, he would never have made the mistake he did, and his company would have been better off to the extent of $80,000. Of course, if the cost records had been made up correctly in the first case and had charged the product only with that proportion of the fixed charges which the actual production bore to the production of the factory when operating at full capacity, he would have seen right away that it was far more profitable to manufacture this product than to purchase it from the outside.

One of the major reasons which has contributed to the remarkable success of Henry Ford has been his thorough understanding of the fact that idleness is the most serious form of industrial waste, and therefore it was important for him to keep his factories operating at full capacity. The following quotations from his book "My Life and Work" bear this out:

> If the prices of goods are above the incomes of the people then get the prices down to the incomes.
>
> * * * * *
>
> We are not much concerned with the statistics and the theories of the economists on the recurring cycles of prosperity and depression.
>
> * * * * *
>
> The Ford production has not reflected good times or bad times; it has kept right on regardless of conditions excepting from 1917 to 1919, when the factory was turned over to war work. The year 1912-1913 was supposed to be a dull one, although now some call it "normal"; we all but doubled our sales; 1913-1914 was dull; we increased our sales by more than one-third. The year 1920-1921 is supposed to have been one of the most depressed in history; we sold a million and a quarter cars, or about five times as many as in 1913-1914—the "normal year". There is no particular secret in it. It is, as everything else in our business, the inevitable result of the application of a principle which can be applied in any business.

The "business cycle" requires to be given careful consideration in the formulation of the plans of a business, but it is quite possible to give it too much consideration. As noted above, Henry Ford goes ahead increasing his business regardless of business cycles, and so did John H. Patterson, founder of the National Cash Register Company. The year 1893 was one of panic, and yet that year was a banner year for the National Cash Register Company. In his book, "John H. Patterson, Pioneer in Industrial Welfare," Samuel Crowther writes as follows:

> The panic broke; the business of the country dropped to nothing. Not so the N. C. R. business—the agents sold on the ground that merchants had so few dollars that they had better take care of every one of them! The year 1892 had been a good one—the company had shipped 15,003 registers as against 11,956 in the previous year. In 1893—the year of "no business"—the company sold the record number of 15,487! That is what intensive selling did.
>
> At the close of the year Mr. Patterson, reviewing events, said: "The year of 1893 has been unparalleled in the history of the United States. Great questions were to be solved, every industry was stagnant, and it was a time when it behooved all large corporations carefully to watch and wait. Some closed down, some lost courage, while a few pushed ahead and worked harder than ever with confidence in the future. We belonged to the very few that did not give up, made extra efforts to succeed, and we are now in excellent condition for 1894."

John H. Patterson is generally regarded as the founder of modern advertising methods and scientific salesmanship. It was he who developed the famous quota system of the National Cash Register Company which has contributed so much to the success of this well-known institution. Originally the number of registers to be sold in a district was calculated on the basis of one for each 400 of population, but as registers were improved and became more varied in type, the number of registers sold was abandoned as an objective in favor of a point system, a point representing $25 of sales. Fig. 5 shows a portion of one of the weekly selling records for the United States and Canada, sent out by this company to its selling force, and showing the quotas and the sales to date for approximately 2000 names. These quotas range from as high as 6000 points to as low as 70 points.

The first step toward setting an objective for the business ship is to determine the volume of sales to be realized or, in other words, to establish a sales quota. Some way can always be found for setting a workable sales quota even though the basis used at the outset may not be entirely scientific. John H. Patterson's original objective of one cash register to every 400 persons may appear crude, and undoubtedly ignored factors which made it unfair in many cases, but it was a starting point and was infinitely better than no basis at all.

The very foundation of scientific sales management and the setting of sales quotas is a knowledge of the market for the particular product being sold. The wonderful development of the chain store systems in this country has been largely due to the careful estimates which are made of the possibilities of a given location before launching a new venture. Before a store is established an estimate is made of its probable business based upon the number and class of passers-by, their habits, and the amount and kind of competition. The sales quota for the store for the first year is based upon this estimate, this quota being revised from year to year to conform to increasing sales possibilities.

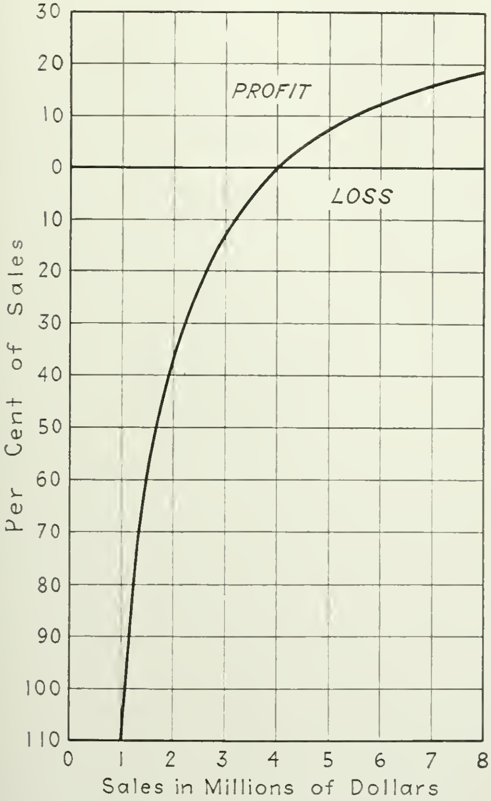


Fig. 4 Profit and Loss Percentage Based on Different Sales Volumes

Compare this procedure with that followed by the average small storekeeper who "guesses" that a certain location would be a good place for a store and finds out by experience whether or not his guess was a correct one. Paul H. Nystrom, author of "Economics of Retailing," relates in his book how he undertook a study of the retail failures in his home city of Oshkosh, Wisconsin, and as a result of this study ascertained that of the 145 merchants in business in that city in 1890 only 18 remained in 1912. The difference between the merchant who goes into business and fails in a few years and the chain store system which rarely abandons a store is that the latter eliminates, as far as possible, all chances of failure by setting up an objective which can be reasonably attained, and then taking steps to see that it is realized. This is a principle which is applicable to every business.

Three Hundred Per Cent Increase in Twenty Months

I was much impressed by an account which was given in the September issue of *Sales Management* of the results obtained by F. S. Fenton, Jr., the general sales manager of Coppes Brothers and Zook, manufacturers of "Napanee" kitchen cabinets. When Mr. Fenton, about 20 months ago, was called upon to take charge of the sales department of this concern he found its affairs in a prosperous condition, and apparently it was doing all the business that could be desired. But after making an investigation of the possibilities of the situation Mr. Fenton came to the conclusion that the sales could be greatly increased, and as a result he was able in the short time of 20 months to increase the sales 300 per cent!

The wonderful growth of the American Radiator Company has been due mainly to the work of its research department and its use of past history and current business trends as a foundation for preparing forecasts of future sales possibilities. In the October issue of *Printers' Ink Monthly,* Warner Bates summarizes the use which this company makes of its research data in its selling and advertising work as outlined in the following tabulation:

1. Sales forecasts
   Which form the basis for making both the advertising and selling appropriations.
   (a) Forecasting sales of currently manufactured products.
   (b) Forecasting sales of new products.
2. Working out branch quotas
   Which enable the company correctly to judge the results of specific advertising and selling effort, to stimulate sales when necessary by special commissions, and to interject into the campaign the field survey when such a step is needed.
3. Market or field surveys
   (To test the plans made, to determine why certain plans have not worked out as expected, and to ascertain the potential market for new products.)
4. Budget control of all departments and branches of the business.
5. Basing the production program on total and zone demand, resulting in closer co-ordination of sales and production, and laying out the distribution program which is based both on production and sales.
6. Establishment of current price policies based on supply, demand, costs, and current market psychology.

Of course, the small manufacturer, who is compelled to cut his coat according to his cloth, cannot have at his disposal a research department of the caliber of that of the American Radiator Company, but he can at least adopt the general principles employed by this company, and it should be remembered in this connection that the American Radiator Company, though now a $75,000,000 concern, was once a very modest affair, and that it owes its growth very largely to the adoption of these principles.

Market Analysis and Sales Quotas

The subject of market analysis and the setting of sales quotas based upon this analysis is obviously one which can be given only brief treatment in an article of this character, and the reader who desires more complete information is referred to works specifically devoted to this subject. It may be helpful to the reader, however, if a concrete case is discussed, and for this purpose we may take the relatively simple one of threshing machinery.

In view of the fact that practically all threshing today in the United States is performed by machinery, it may be assumed as a general proposition that the demand for threshing machinery in the different territories should be proportionate to the production of threshable grain in these territories. Now, as is the case in many industries today, the producing capacity of threshing machinery manufacturers is in excess of the apparent capacity of the country to consume, so that the average factory is not operating at full capacity throughout the year. The objective of the threshing machinery manufacturer, however, should be to endeavor to obtain sufficient business to keep his factory operating at full capacity continuously and thus eliminate the great loss resulting from the idle time factor. His correct procedure would therefore appear to be first to determine the total number of threshing machines which his factory could produce by continuous operation at full capacity; and then to apportion these machines as sales quotas to his different sales branches in proportion to the average production of threshable grain in their respective territories. If the total crop were considerably under normal he would probably be compelled to carry over some in inventory of finished machines at the close of the season, as it is necessary for the manufacturing program to be in the main completed before the results of the harvest can be definitely determined. In the event of an unexpectedly great demand for machinery resulting from a particularly fruitful harvest, this demand could doubtless be met to some extent by working the factory overtime for a period.

At the commencement of the year a preliminary program would be laid out for each branch showing, first, the sales quota; and second, the sales force to be employed to realize this quota. Individual quotas would be set for each salesman and in addition a careful estimate would be made of the sales expenses of the branch.

A careful study would be made throughout the season of the crop forecasts, and of the reports turned in by the salesmen, the program being modified from time to time to conform to variations between the estimated and the actual conditions. At the close of the year the sales performance of the manager and his salesmen would be judged on the basis of the relationship between the actual crop and the volume of sales.

Modifications of the Quota Plan

Some modifications of the plan outlined above, which, of course, is merely suggestive, would undoubtedly be required. Comparisons of past results with the quotas figured on the basis of the threshable grain production would probably show that some branches had been operating less efficiently than others. It would be expecting too much to require the managers of these branches to realize their full quotas the first year. The selling of threshing machines, like other products, depends largely upon the groundwork laid down by the sales force in the collection of the names of prospects, and other factors, and a certain amount of time would be required to bring an inefficient branch up to the proper standard. In such a case, however, there should be a definite program laid down and a certain period allotted for realizing the required result.

Now the sales analysis problems facing the manufacturer of cream separators would be very different from those to be met by the manufacturer of threshing machines, because the farmer with one or two cows would probably not consider a cream separator a necessary investment. Whereas, other things being equal, the demand for cream separators in a given territory should be in direct relation to the number of milk cows on the farms it is obvious that in a state like Wisconsin, where the average number of cows per farm is 12.8, the quota per cow should be far greater than in Kentucky where the average number of cows per farm is only 2.49.

Factors Which Modify Demand

The marketing problems of various industries are different, and no general rules can be laid down which would be applicable in all cases. In the case of a luxury market the demand is influenced in great measure by an increase in the national income, but it is also increased by a reduction in price so that the article comes within the means of a lower range of incomes. It was only a few years ago that the automobile was a luxury which could be afforded by only the relatively well-to-do. The tremendous increase in the number of automobiles has resulted in the main from the reduction in price. In this connection the reader will recall Henry Ford's remark quoted above: "If the prices of goods are above the incomes of the people then get the prices down to the incomes".

In the case of a necessity such as food or laundry soap, in a normally well-to-do nation like the United States the consumption will not be notably expanded by an increase in the national income. This applies more particularly to foods, for it is reasonable to assume, though I do not have the figures to prove it, that increased prosperity may result in increased use of laundry soap through stimulating individuals who formerly wore a shirt two days to change linen daily! In the case of foods, however, as was pointed out by a recent writer in the *Harvard Business Review,* in a period of hard times the average caloric intake is not reduced, but the diet is cheapened by substituting lower price calories for higher price calories. For instance, when times are hard the consumption of meat in the north is reduced and that of wheat increased, whereas in the south the use of corn rises and that of wheat declines. In the case of a necessity like food, therefore, any increase in the sales of one commodity is only obtained by a decrease in the sales of some other food commodity. It will be obvious from the above that the manufacturer of foodstuffs, in making his sales forecasts, should give careful consideration to the position of the country in the economic cycle.

Sales quotas are of little use if they cannot be converted into realities, and salesmen should be paid as far as possible in proportion to the results obtained, and their interest in realizing their quotas should be constantly sustained. If reference is made to Fig. 5 it will be noted that each National Cash Register salesman has a sales quota set for him for each month and that each week he is advised as to his standing and that of every other salesman in relation to the quota. Every salesman who reaches his yearly quota automatically becomes a member of the famous Hundred Point Club. Mr. Crowther's book states:

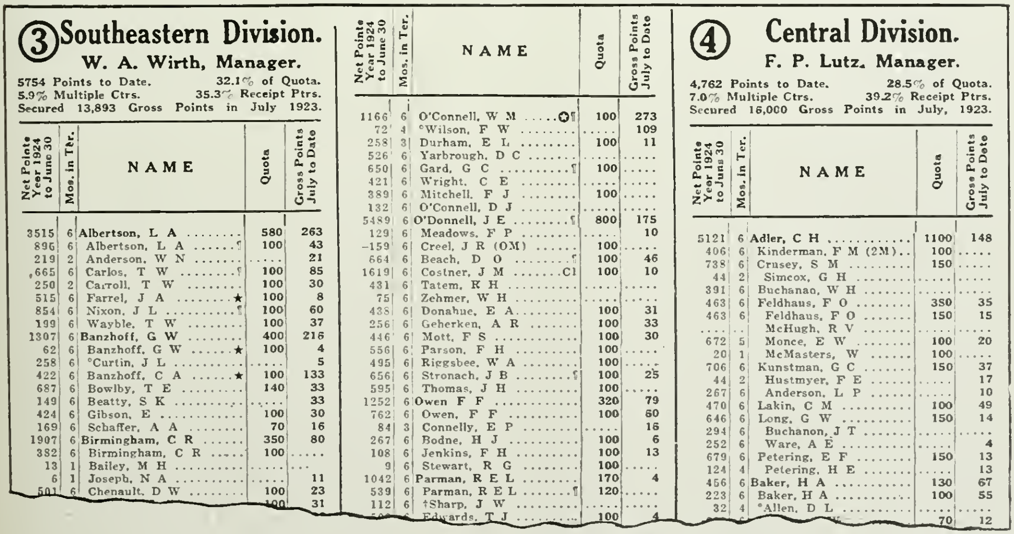
> In the early days all the salesmen came to Dayton for the annual conventions, but as the sales force grew larger this plan grew less feasible and the practice began of holding conventions out in the districts. But it seemed advisable that at least a certain number of salesmen should meet at Dayton each year so that the sales force and the factory should keep in close touch.
>
> Mr. Patterson hit upon the plan of making the trip to Dayton a reward for merit. . . . The men who sold their full quotas were designated members of the Hundred Point Club and invited to Dayton for the annual convention. . . . During the latter years of Mr. Patterson's life the conventions became more elaborate, winding up with an excursion to New York at the company's expense.

Since Mr. Patterson's death even greater inducements have been offered to the National Cash Register salesmen to realize their quotas and become members of the Hundred Point Club. Five hundred and forty-nine members of the Hundred Point Club in 1923 made a trip to Bermuda at the company's expense in a steamer specially chartered for the trip. This year the reward will be a 6000-mile trip to California.

Though it is not possible to formulate definite working plans for setting sales quotas suitable for all manufacturers, the data required in the program for obtaining maximum profits can be summarized thus:

1. Set sales quotas for:
    - Each line of product
    - Each territory
    - Each salesman
2. Set standards for the cost of realizing these sales quotas including all items of sales expense as:
    - Salesmen's salaries
    - Salesmen's traveling expenses
    - Salesmen's commissions
    - Branch house expenses
    - Sales administrative expense
    - Advertising

The next article will give practical illustrations and diagrams of the actual use of sales quotas and standard selling expenses in the operation of a business.



③ **Southeastern Division.**

W. A. Wirth, Manager.

5754 Points to Date. 32.1% of Quota.
5.9% Multiple Ctrs. 35.3% Receipt Ptrs.
Secured 13,893 Gross Points in July 1923.

Net Points Year 1924 to June 30	Mos. in Ter.	NAME	Quota	Gross Points July to Date
3515	6	**Albertson, L A**	580	263
896	6	Albertson, L A ¶	100	43
219	2	Anderson, W N	.....	21
,665	6	Carlos, T W ¶	100	85
250	2	Carroll, T W	100	30
515	6	Farrel, J A ★	100	8
854	6	Nixon, J L ¶	100	60
199	6	Wayble, T W	100	37
1307	6	**Banzhoff, G W**	400	216
62	6	Banzhoff, G W ★	100	4
258	6	°Curtin, J L	.....	5
422	6	Banzhoff, C A ★	100	133
687	6	Bowlby, T E	140	33
149	6	Beatty, S K	.....	33
424	6	Gibson, E	100	30
169	6	Schaffer, A A	70	16
1907	6	**Birmingham, C R**	350	80
382	6	Birmingham, C R	100	.....
13	1	Bailey, M H	.....	...
6	1	Joseph, N A	.....	11
501	6	Chenault, D W	100	23
			100	31

Net Points Year 1924 to June 30	Mos. in Ter.	NAME	Quota	Gross Points July to Date
1166	6	O'Connell, W M ✪¶	100	273
72	4	°Wilson, F W	.....	109
258	3	Durham, E L	100	11
526	6	Yarbrough, D C	.....	.....
650	6	Gard, G C ¶	100	.....
421	6	Wright, C E	.....	.....
389	6	Mitchell, F J	100	.....
132	6	O'Connell, D J	.....	.....
5489	6	**O'Donnell, J E** ¶	800	175
129	6	Meadows, F P	.....	10
−159	6	Creel, J R (OM)	100	.....
664	6	Beach, D O ¶	100	46
1619	6	Costner, J M Cl	100	10
431	6	Tatem, R H	.....	.....
75	6	Zehmer, W H	.....	.....
438	6	Donahue, E A	100	31
256	6	Geherken, A R	100	33
446	6	Mott, F S	100	30
556	6	Parson, F H	100	.....
495	6	Riggsbee, W A	100	.....
656	6	Stronach, J B ¶	100	25
595	6	Thomas, J H	100	.....
1252	6	**Owen F F**	320	79
762	6	Owen, F F	100	60
84	3	Connelly, E P	.....	16
267	6	Bodne, H J	100	6
108	6	Jenkins, F H	100	13
9	6	Stewart, R G	100	.....
1042	6	**Parman, R E L**	170	4
539	6	Parman, R E L ¶	120	.....
112	6	†Sharp, J W	.....	.....
	6	Edwards, T J	100	4

④ **Central Division.**

F. P. Lutz, Manager.

4,762 Points to Date. 28.5% of Quota.
7.0% Multiple Ctrs. 39.2% Receipt Ptrs.
Secured 16,000 Gross Points in July, 1923.

Net Points Year 1924 to June 30	Mos. in Ter.	NAME	Quota	Gross Points July to Date
5121	6	**Adler, C H**	1100	148
406	6	Kinderman, F M (2M)	100	.....
738	6	Crusey, S M	150	.....
44	2	Simcox, G H	.....	.....
391	6	Buchanan, W H	.....	.....
463	6	Feldhaus, F O	350	35
463	6	Feldhaus, F O	150	15
....	..	McHugh, R V	.....	.....
672	5	Monce, E W	100	20
20	1	McMasters, W	100	.....
706	6	Kunstman, G C	150	37
44	2	Hustmyer, F E	.....	17
267	6	Anderson, L P	.....	10
470	6	Lakin, C M	100	49
646	6	Long, G W	150	14
294	6	Buchanon, J T	.....	.....
252	6	Ware, A E	.....	4
679	6	Petering, E F	150	13
124	4	Petering, H E	.....	13
456	6	**Baker, H A**	130	67
223	6	Baker, H A	100	55
32	4	°Allen, D L	.....	.....
			70	12

FIG. 5 PORTION OF NATIONAL CASH REGISTER COMPANY'S WEEKLY SELLING RECORD

Single stars show 100 per cent quota secured. Circled stars show 200 per cent of quota secured. Paragraph marks show candidate for C. P. C.

Advantages of Standardization to Industry

By F. J. SCHLINK

Assistant Secretary, American Engineering Standards Committee

In its work on industrial standardization, the American Engineering Standards Committee has had occasion to compile a fairly complete statement of the advantages which accrue to industry by the adoption of standards. National standards, as will be seen from the analysis below, afford the advantages named to an enhanced degree, as compared with standards accepted only within a given industry.

I. Standardization Systematizes Business.
  1. Standardization expedites business, shortens the time required for delivery, and stabilizes production, employment, and financing, making it safe to build up stock during slack times against future orders.
  2. It furthers the tendency to put business undertakings on a systematic basis and to eliminate purely traditional practices.
  3. It tends to eliminate indecision, both in production and utilization, thereby promoting efficiency and saving time and materials.

II. Enlarges Markets.
  1. Products manufactured in accordance with standards that are nationally recognized, reach a wide market through the effective and dignified national publicity that is given the standards during their development. Qualities known in one industry become known and accepted in industry generally.
  2. Standardization will build up foreign trade. In gaining recognition for its standards in foreign countries, an exporting country establishes an important point of contact and business outlet for its industries.
  3. It simplifies the buyer's problem and raises the standard of salesmanship, by focusing attention upon fundamentals. Standardization places competition upon the basis of essentials, eliminating minor variations.
  4. It simplifies the problem of ordering, since standard material need not be described in detail, but may be referred to by number, or by a recognized name and a generally accepted capacity or size designation.

III. Better Serves the Consumer.
  1. It favors interchangeability of parts, due to the higher accuracy of standardized manufacture, and so makes possible quick deliveries. It assures prompt and satisfactory replacement of parts in making repairs; in emergencies such parts can be taken from other machines or equipment not in use.
  2. It increases quality of production by the use of improved tools, materials and processes, reducing labor, overhead, and hence prices.
  3. It furthers efficient co-operation between the units of industry, experience gained in standardization work being of direct value in co-operative work in all technical lines.
  4. It acts as a powerful stimulus to research and development by bringing out the need of new facts in order to determine what is best and most economical, and to secure agreement on moot questions.
  5. Standardization protects the buyer, who can ordinarily have no first-hand or expert knowledge of the things bought. Furthermore, with standardization, buyer and seller are enabled to speak the same language.

Index Number
658.516 Standardization

IV. Reduces Direct and Indirect Expense.
  1. Standardization reduces investment in materials and repair parts, simplifies maintenance, saves office work, and permits the salvaging of standard parts from obsolete, rejected, or worn-out tools or equipment.
  2. By fixing good practice, it establishes quality and eliminates the burden of repeatedly designing and setting up of machines for the making of articles which should be identical.
  3. It decreases unit costs by permitting mass production, thus reducing the number of changes and adjustments of machines required, and permitting continuous employment of personnel, and full-time use of tools and machines. In these and in other ways, it simplifies the financing of the business.
  4. It reduces the number of specially-trained workmen required, by reducing the number and variety of processes and operations.
  5. It increases output of workers by making possible the application of specialized machinery and tools, and results in increased skill and speed due to repetitive processes.
  6. It decreases the work of personnel in
    (*a*) Supervision and training of workmen.
    (*b*) Designing, drafting, and engineering, by concentrating expert knowledge on a few highly developed lines.
    (*c*) General administration and management, by making possible cheaper and more complete advance planning and calculation in estimating, scheduling, ordering, recording, and cost accounting; in conveying, distributing, and shipping of product; testing, and inspection; bookkeeping; maintenance, repairs and operation.
    (*d*) Selling; a standardized product can be sold more readily, as the purchaser is aware of its advantages, and has confidence in its quality.[1]

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[1] The A. E. S. C. will furnish further details on request.

Getting the Executive Program Across

Building Tractors Under Scientific Management—VI

By GEORGE D. BABCOCK

Manufacturing Executive, Holt Manufacturing Company

Index Number
658.1 Executive control

IN the earlier articles of this series we have discussed the underlying principles of management and the routine that has made these principles effective in the Holt plant.[1] But the best plant routine in the world would be ineffective to make a business successful unless the executive management applied to its problems the same general principles that make the plant run smoothly and deliver its scheduled product exactly on time, day after day. Chief among the principles governing successful plant operation is pre-planning. We have seen how this covers everything from the authorization of the manufacturing schedule down to the moving of finished tractors off the line on the assembly floor. But back of the authorization of the manufacturing schedule is the decision of the general policy of the company, and pre-planning is just as essential here as it is for the activities of the shop. And this pre-planning is the job of the executive.

Before pre-planning in the executive end can be taken up, several classes of information are needed. First and foremost of these are the answers to the two questions: "What will be the volume of sales during the next six months or the next year?" and "How much money will be needed to finance the business of the company for the six-month or twelve-month period?" The answer to the second question depends largely upon the answer to the first one. The answer to the first one is not so easy. Some of the factors that enter into it will be considered a little later.

Problems for the Executive

Other problems that confront the executive are the general labor policy to be adopted, whether the plant shall be restricted with respect to labor affiliations, whether there shall be employee representation or not, and what the attitude shall be to attain good relationship with the men. The general policy of purchasing must be worked out, and the markets from which the company draws its raw material must be watched carefully to avoid heavy commitments at times when prices are high. In the purchasing policy must be a decision as to whether certain parts entering into the final product shall be purchased outside or made within the plant.

Another problem that the executives must solve is that of the adequacy of design of the product, and the degree to which standardization shall be carried. Whether or not present designs are sufficiently in line with the development of the field to compete successfully with those of other manufacturers is a question that the executives must study from every angle. If the answer is affirmative, they can carry standardization to a high degree. If it is negative, they must decide how, and to what extent, the design must be overhauled. In line with this, the executives must also decide whether or not the designs cover the possible field of sales, or whether new designs or products must be developed in order to exploit new fields or to hold on to those already developed. These latter problems are outlined to a large extent by the sales analyses that form part of the pre-planning of the sales program.

Size of Labor Force to Meet Requirements

The foregoing are broad questions of policy that effect the activities of the business as a whole. The executives in charge of manufacturing must necessarily join in their solution. In addition, the manufacturing executive has a few distinct problems that are peculiar to the operation of the plant itself. Among these problems is the size of the labor force needed at each period of the manufacturing schedule to meet exactly the requirements of that schedule. A phase of this problem is the necessity at times of deciding when it will be advisable to operate two or three shifts of men, or whether the whole plant or certain departments of it should be operated overtime. Still another problem is to ascertain the number of parts that represent a high inventory value, and hence should be manufactured in small lots at frequent intervals, and the number of parts that represent low values, and consequently can be put through in large lots. The policy adopted as the result of such a study may decrease to an amazing degree the amount of money locked up in inventory each year.

Figs. 29 and 30 show, respectively, a set of curves and a chart that give the manufacturing executive absolute control of the manufacturing activities. The curves, Fig. 29, show the relation between the labor force available and the amount of work ahead of the shop. The chart, Fig. 30, shows the condition of each machine as regards work ahead and also whether the machine is at work or idle. If idle, it shows the reason for this condition of affairs, so that the executive can take the necessary steps to correct it. The curves and the chart are used in conjunction, the information given by one supplementing that given by the other.

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[1] See MANAGEMENT AND ADMINISTRATION for June 1924, p. 647; July 1924, p. 19; August 1924, p. 141; September 1924, p. 265; October 1924, p. 377.

In Fig. 30, each horizontal row represents a separate machine. Each vertical column represents a working day. Each rectangle representing a working day for each machine is ruled into smaller rectangles representing subdivisions of the day. Whenever a machine is shut down, for any cause whatever, an "Idle Machine Ticket" is made out in the shop and forwarded to the route and equipment department. This ticket carries a statement of the cause of idleness, as "No work at machine," "No man available for machine," "Breakdowns," etc. The route and equipment department initiates the necessary steps to correct the conditions causing the idleness, if such conditions are within its control. At the same time, it posts the idleness on the chart by putting a pin with a colored head in the row representing the machine in question and at the day and hour when the idleness occurred. When the machine is again at work, the rectangles representing the hours it was idle are filled in with colored crayon. Several colors are used each having a significance as shown in the legend of Fig. 30. In the space above each row representing a machine are entered daily the figures representing the number of jobs ahead of that machine, as shown by the work orders or job tickets on file in the dispatch racks.

It is evident that a glance at these charts gives the manufacturing executive a vivid picture of the condition of the entire plant. When all machines are at work, the charts will be entirely clear of color, and he will know that the entire machine capacity of the plant is employed. If, on the other hand, there is a predominance of black on the chart, he will know that machines are idle because there is no work available for them, and that a reduction in the working force is indicated, unless the sales department has reported the need of increased production to meet an expected future demand for tractors. If the color predominating is red, he is aware, without further investigation, that the idleness is due to lack of men, and if the jobs ahead of the shop as shown by the curves in Fig. 29 are increasing, an increase in the working force is indicated. If there is an unusual amount of yellow showing, it indicates that the maintenance and repair forces are either becoming lax or overburdened, so that they cannot keep the machines in running order. In short, the relative quantity of the several colors on the chart at any time indicates the general policy to be followed, from the executive standpoint, without the need of investigating details.

From the figures of jobs ahead of each machine, as posted on the charts, the curves of Fig. 29 are plotted weekly. The number of men in each department is reported by the personnel department, and these figures are also plotted. The trend of these curves indicates changes in conditions in the shop as they take place from week to week. Thus, the steady rise in the direct labor curve is evidently due to the increase in the number of men employed in the machine shop, made necessary by the piling up of jobs ahead in the machine shop. In Fig. 29 it will be observed that in June, the labor force apparently became stabilized. The curve of jobs ahead in the machine shop, while still not stabilized, had ceased its general upward trend. The stabilization of the labor force indicates that the shop has reached its limit of capacity as regards men employed on a single shift.

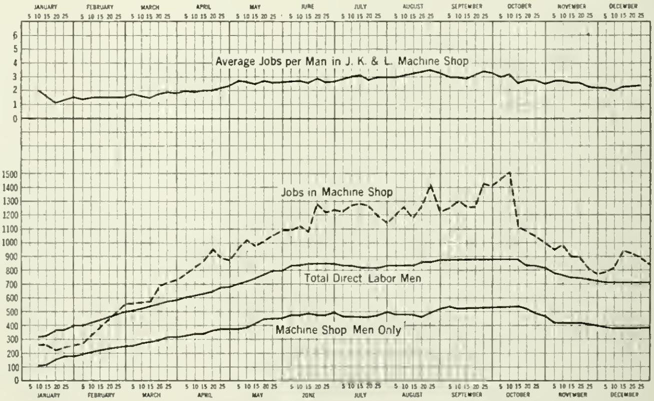

FIG. 29 CURVES SHOWING RELATION OF WORK AHEAD AND NUMBER OF MEN EMPLOYED

This would be confirmed by a glance at the Machine Burden Record Chart, Fig. 30. If this chart shows no colors whatever, excepting possibly yellow or green, showing that machines were idle for purposes of repair or because special tools were lacking, the manufacturing executive knows without further investigation that no greater production can be expected unless the machines are operated for a longer period each day, either by means of overtime or by the addition of a second shift of men on some or all of the machines. The figures entered over the space allotted to each machine daily will serve as a guide as to where pressure should be placed to increase production. If one class of machines shows on the chart an increase in jobs ahead that is out of proportion to the jobs ahead on other classes of machines, then overtime or second shift operation on that class is indicated. If, on the other hand, no one class of equipment shows on the chart as being more heavily loaded than any other class, then, with the curve of total jobs ahead still rising, overtime or a second shift for the whole shop is the solution.

Curves similar to Fig. 29, and a chart of the character of Fig. 30 are the most useful records that the executive in charge of manufacturing can have. The particular form that these records take is unimportant. The main thing is that they must give him an accurate picture of the shop and its operations, upon which he can base his plans for the future. If in addition to these records, the executive has a plot of the sales and shipments promised each day for several months ahead, he is well fortified with knowledge for preplanning the activities of the plant as a whole. By plotting the sales and promised shipments alongside of the authorized production schedule, any changes that may be necessary become immediately apparent.

Formulating the Sales Policy

Thus in the case of the Holt Company, the tractors available for shipment in any month are comprised in the inventory at the beginning of that month plus the expected production during that month. By plotting these figures and also the sales, the trend of the two curves will indicate whether or not production is proceeding at too rapid a rate for the market to absorb it, or whether at some time in the near future the curve of sales will cross that of inventory plus production. Should the latter event occur, the company would be out of tractors and might lose orders due to its inability to make immediate shipment.

On the other hand, should the trend of sales be such that tractors will accumulate at a rate higher than desirable, a large amount of money would be tied up in inventory. By watching the changes in the trend of the curves, the intervals at which the various lots called for by the manufacturing schedule should be started in the shop can be increased or decreased as occasion demands. It is this careful day-by-day survey of conditions both inside and outside that has had much to do with the enviable production record that the shop has achieved during the past three years.

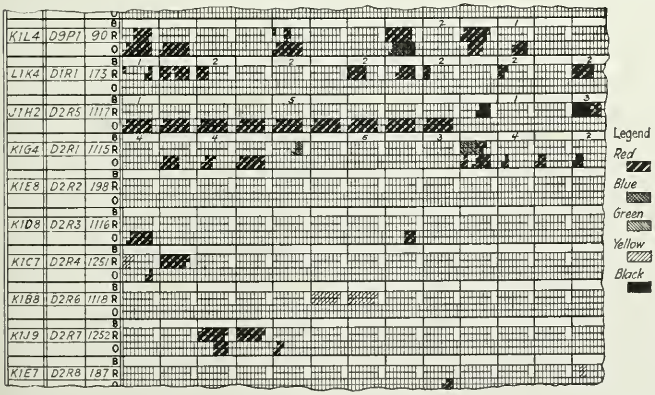

FIG. 30 MACHINE BURDEN RECORD CHART

The colors on the chart as shown by the legend have the following significance: Red, no operator assigned; blue, no work at machine; yellow, machine shut down for repairs; green, tools lacking; black, no orders assigned.

Sales are susceptible of pre-planning as in manufacturing. In fact, if there is no definite sales policy of some kind, there can be no definite manufacturing program. One of the most important details of executive pre-planning, therefore, has been in the sales end.

This has taken several directions: Previous sales by types; adequacy of design for the present market; extent of the present market; percentage of present market that should be sold each year; possible markets not at present reached; adequacy of present design for these markets; methods of reaching these markets and percentage of the markets that should be sold. These are but a few of the factors that had to be considered in relation to the sales program.

As an endeavor for sales pre-planning, a survey of the entire world was made to determine the extent of the possible markets that could be reached. For instance, the possible extent of the market for tractors for logging in the northern woods of the United States was estimated, and also the market for tractors in the logging camps in the southern swamps. Another possibility that opened up after the armistice was the use of the tractor for road making, and a study was made to determine how great was the probable market in this direction. Similar studies were made in regard to practically every country in the world, and a definite policy of reaching all these markets was adopted. A description of the methods employed in this study has no place in this series. It is sufficient to state that they resulted in a definite manufacturing program, calling for a definite number of tractors of each type and design made by the company, to be delivered to the sales department over a given period. Without this precise knowledge of the volume of product that would be required, it would be difficult, if not impossible, to obtain the results that have been obtained at the Holt plant. All our efforts to perfect a shop organization and to build up a shop routine would be largely wasted if it were not possible for us to have fairly accurate knowledge of how many tractors we would have to make and when we should make them.

In an earlier article in this series, we touched on the personnel problem that had to be worked out at the Holt plant before we could obtain complete control of production.[2] Before we reached the present harmonious relations with our men, several phases of the labor problem were encountered and worked out. The most important of these was the question of employee representation. Some of our experiences with this follow:

In May 1919, a group of three men from the shop applied to the manufacturing executive for permission to form a committee to represent the men in their dealings with the management. In this request from the men themselves, the management saw an opportunity to deal with a definite body where policies could be built up and a closer relationship established between management and men. The management, therefore, authorized the formation of a shop committee to operate under certain fundamental principles of management. The fundamentals have been described in an address by the writer before the Society of Industrial Engineers at Chicago in September 1919.

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[2] See MANAGEMENT AND ADMINISTRATION, August 1924, p. 141. "Organizing the Personnel for Production."

These fundmentals are:

1. Employers will practice no discrimination against employees.
2. Employees will practice no discrimination against employers or against fellow employees.
3. Employees will practice no restriction of productive output.
4. Employers and employees shall share equitably in the economic returns of Scientific Management.
5. Permanent relations between all parties will be insured by the reduction, so far as possible, of the activities of the industry to standards for guidance. These standards will be established, so far as possible, by collective determination and agreement among all persons who may effect the results.

The fundamentals were adopted as the basis of all dealings between the management and the men, in the formation of the shop committee.

The Operation of the Shop Committee

The committee was chosen entirely by the men, the management taking no part whatever in the selection. At this time there were about 30 departments in the plant, and each one selected a man to represent it, making a general committee of 30 members. This committee in turn elected from its members a central committee of 3 members, one of whom was chairman.

It was determined that the point of contact between men and management should be the personnel control department, and grievances were first reported to the personnel manager through the chairman of the central committee. The personnel manager would then refer the matter to an investigator from his office, who would determine and analyze all the facts on both sides of the question and report back to the personnel manager. The findings of the personnel manager would then be given to the chairman of the central committee, who, in turn, would take the matter up with the individual whose case was under consideration. The findings of the personnel manager were based on the 5 fundamental principles, as defined above.

These grievances of the men were presented in an unsystematic way and at irregular intervals. As the number of employees increased, and also the list of cases to be considered, the general committee was increased to 50 members, and the central committee was increased to 8, chosen from these 50. The personnel supervisor was called on to assist the personnel manager in handling the cases. It was found that, to avoid repetition and to eliminate the necessity of investigating numerous cases of like nature, open and free discussion of the problem should be had in order to establish precedents which later might be embodied in standards for guidance. In order to do this it was determined that the entire committee should meet with representatives of the management once each week when all matters might be taken up and conclusions reached. In this way, minor cases were adjusted promptly and with the minimum of friction. The meetings were held partly on the men's time and partly on the company's time. The matters presented at each meeting were written up and copies of the minutes of the meeting were distributed to each committee man on the morning following the meeting. Matters requiring investigation by the personnel manager would be reported on at the next following meeting, and the information would thus be conveyed by the central committee man either to the general committee man of the department affected, or directly to the individual affected.

The matters taken up by the committee comprised principally hourly rates for individuals or for trades, and as decisions regarding these were reached and precedents were established, they gradually gave way to topics of a more general nature, such as hours of work, safety devices, shop facilities, street car service, etc.

At first the committee helped materially in bringing a better understanding, between management and men, of their respective duties, obligations, and responsibilities. On one occasion, during the turbulent industrial conditions existing in the fall of 1919, when nearly all the local industries were tied up in a general strike, our men, who were strongly organized, refused to submit to the solicitation of the strikers to join in a general sympathetic strike. This, we think, was due largely to the sane and level-headed attitude of certain of the committee members, and was the most striking demonstration of the usefulness of employee representation during its two years of operation in the plant.

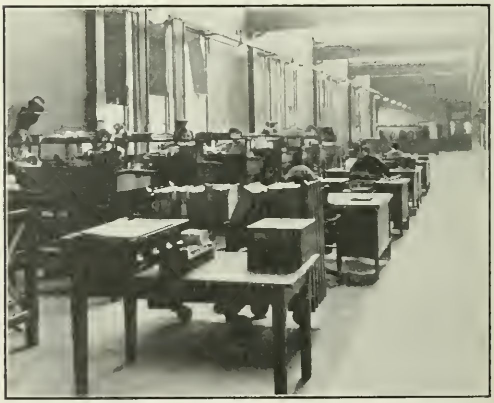

FIG. 31 THE PRODUCTION CONTROL DEPARTMENT OF THE HOLT MANUFACTURING COMPANY IN MAY 1924

Prior to Scientific Management, this entire room and two others were filled with production control clerks.

Objections to Committee Representation

The main objection to this committee form of representation is that for the most part the committee men never truly represent the men. Findings of the committee would not be reported as found to the working force, and there was a continuous attempt on the part of the committee members to play politics and to bring the impression to the working organization that all things brought through that were good for them, were created by the committee. Opinions of the men were distorted when they reached the management. A small group of men, including the committee, would on occasions confer and decide upon some act which they believed was desirable to carry through. At the time of development it was frequently evident that the working force, as a whole, had not even thought of such arrangements. The committee would then school the group, to a limited extent, or would have a meeting in the city, in which they would perfect their desires. They would then present the matter to the management members of the committee as if it had been a spontaneous desire on the part of the workers.

FIG. 32 THE PRODUCTION CONTROL DEPARTMENT, LOOKING IN THE OPPOSITE DIRECTION FROM THAT IN FIG. 31

During the two years that the committee was in operation, the management earnestly endeavored to make such operations successful. The development was carried to a thorough test in all its branches, but for the reasons stated we abolished it in the spring of 1921 and have not reinstated it.

We went into all angles of the problem of good relationship and successful conduct of our labor affairs with our employees, and found the sensible and most natural solution was to deal in all matters just as we would carry on our relations with any other individuals or groups; that is, to meet any problem which might arise either in our executive staff or between our executive staff and the shop force, either individually or collectively.

If any organization is promulgated and maintained for the sake of complaints, then there is little probability that that same organization will bring through recommendations for betterments. If it be a matter of wages, or a matter of hours of work, it cannot be overlooked that those who are affected by those hours are obviously very deeply interested in this particular question. It will be of major importance to that group, while another group may be worried about getting incoming materials or shipping out finished products.

I have said that the obvious thing would be to handle problems of any nature by the natural way, and I can see no more natural and no more successful way of handling the relations with employees than to have no rules or regulations closely binding on their activities, except, as is necessary in all industrial operations, to see that the product comes through in quality, time, and place, under the highest possible efficiency of operation, and that all individuals from the management down contribute their share to this end. For that reason we make no effort whatever to learn of any affiliation of those whom we employ, whether it be religious or fraternal or with a labor organization. We try to be continually watchful that our responsibility to our employees is carried out in its many ramifications, and we do keep in very close personal touch with our men and their activities and their problems. We respect their personal affairs as we would those of our neighbor, entering into them or assisting only if they take the initiative and ask us, by virtue of our greater facilities, to assist them. We have no idea that, because they are gathered together in a large group under our administration, we control their destinies.

Our employees are confident of our earnestness and honesty of intentions in our dealings with them. They have realized that by joining in to the limit to make successful those things which they realize are desirable for the maintenance of the industry, they have not jeopardized their interests nor placed themselves in a position where the management has selfishly taken advantage of such co-operative effort. One of the strongest objections today from labor toward Scientific Management is that it puts within the hands of the selfish or thoughtless manager the opportunity to force his men to work under excessive tasks. But, to the everlasting credit of Scientific Management, there has never been a case in which management, such as has been described in this series, has failed to benefit the employees and very materially to improve their working conditions. This is to be expected because Scientific Management is based on an analytical study of cause and effect, and intelligent and honest study disposes of the greatest number of objections to the older forms of industrial management. There is a misconception, not alone among employed but also among employers, that Scientific Management is some form of rate setting with some bonus or differential of pay based on the work itself. This is erroneous. Only the smallest part of the total effort put forth in the introduction of Scientific Management is applied to these details, and mere details they are.

The Attitude of the Workmen Today

The attitude of the workman toward the methods of Scientific Management may be appreciated by a conversation which occurred between a couple of the men and a visitor to the plant, whose object it was to learn for himself at first-hand the results of Scientific Management. After a general discussion with the men as to the difference that existed between the conditions during and immediately after the war, and at the present time, the question was bluntly put: "Would you rather work the way you did then or the way you now do?" The answer was a prompt and emphatic declaration for the present methods. On being pressed for a reason, the man replied. "Because it's easier for us now. We know what we have to do without chasing a foreman to find our next job. We get the stuff to work with without having to hunt all over the shop for it or going to the storeroom and finding that we haven't got it. Besides, there aren't a lot of job chasers after us all the time to hustle up jobs and break up work that we are doing."

Reduction of Labor Turnover

Such an attitude reflects one of the great indirect advantages that Scientific Management gives to the plant that employs it. It reduces the labor turnover and gives the plant a picked body of the best workers. The men who leave the plant have difficulty in finding another job where the conditions of work are so agreeable as in the plant under Scientific Management. Consequently, there is a reluctance to change jobs, and the labor force is stabilized. The same workman quoted above also remarked: "The way we do things now shows up a lazy man and he soon quits." The result of this is that within a comparatively short time only the higher grade of workers are found as permanent members of the force.

Another indication of the spirit that actuates the men is their interest in the maintenance of the record of exactly-controlled, scheduled production. On May 1, of this year, this record stood at upwards of 600 consecutive working days,[3] and the men are as much interested in keeping it unbroken as is the management. It has become a game with them, the Holt workmen against the field, to show the best production record in the world. There is a standing order by the management to blow the fire whistle on the plant if and when the erection department ever fails to deliver its scheduled output on time. In the good-natured bantering that always takes place between shop departments, the erection foreman has been told that if the whistle ever blows he will have to make a quick start to get away from the men whose record has been spoiled. His reply invariably is: "It's never going to blow." Such a spirit in a working force is one of which any employer may well be proud.

Summary of Good Results

We may now sum up briefly what Scientific Management has accomplished for the Holt Manufacturing Company:

First, it has given us a product that is equal to any legitimate demand that may be made upon it, a product of uniformly high quality due to the methods of testing and inspecting raw material, and the close supervision of quality of workmanship that follows every stage of the manufacturing process. It is needless to raise any question as to the value to any manufacturer of a reputation for high quality.

Second, it has given us such absolute control of our production that we are able to tell a customer, months in advance, the exact day on which his order will leave our plant. A reputation for *always* meeting delivery promises is second only to that for highest quality.

Third, it has enabled us to decrease our costs while at the same time paying the highest wage scale of any factory in the district in which the plant is located.

Fourth, it has secured for us a picked body of workmen, highly skilled at their work, proud of their association with the company, and absolute in their faith in its fair dealing toward them. There is no finer body of men anywhere in the world than those employed in the Holt plant.

Fifth, it has noticeably decreased the labor of administration of the plant. Scientific Management has suffered much from statements that it increases the so-called "non-productive" overhead and enmeshes the organization in a tangle of red tape. In refutation of this unproved claim, the writer offers the evidence of the two photographs of the production control department of the Holt plant, Figs. 31 and 32, taken in May 1924. Previous to the installation of Scientific Management, all the vacant space shown in the two photographs was filled with clerks handling the production routine. In addition, two large rooms were filled with clerks also engaged on production control work. The desks shown, together with a few in the route and equipment department, most of which discharge functions ordinarily carried out by an engineering department, today control an output over twice as large as that formerly controlled by a force over three times as great.

Scientific Management Cuts Overhead Costs

Our indirect or overhead rate has receded steadily since the introduction of Scientific Management, even though many hours which had been previously considered as direct, were transferred to the indirect classification. Personally, where accurate costs are compiled and maintained, I cannot conceive that it is important whether an employee be classified in the indirect or direct side of the cost, but I do consider it vitally important that all of the costs, so far as possible, which are created in production, should be allocated to their true places.

As to the implication that the paper work is extensive, or that red tape is prevalent, I can say that there is no entry on a single form that does not mean a corresponding shop operation. Therefore no places for entry on any of the forms can be omitted. We recognize forms as standardized orders of the management for the detailed conduct of its affairs, and as conditions require changes of standard, the forms are immediately changed to agree. It is only by thus clearly and definitely showing the work to be done that production can be kept exactly on schedule.

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[3] On October 15, when this issue of MANAGEMENT AND ADMINISTRATION went to press, the record stood at 734 consecutive working days.—*Editor.*

Specifications for Pipe Coverings

By HUBERT E. COLLINS

Mechanical Engineer

Index Number
621.774 Pipe specifications

THE same general rules for specifying quantity and size of insulation should be followed as when ordering pipe and pipe fittings,[1] with the following additional information given.

Pipe covering comes in sections 3 ft. long to fit the size pipe it is to cover. Molded covering for fittings comes in all pipe sizes to cover standard-size fittings. Where a reducing fitting is to be covered, one is furnished for the standard-size fitting all around and the reductions are filled in with cement of the same material as the covering.

The total length of pipe to be covered should be ordered and this amount will be shipped plus what will come over in one 3 ft. length. The fittings should be ordered in pipe size and the statement made whether they are screw or flange fittings.

Kind and Quality

The real object of insulation is to prevent the flow of heat to the outside surrounding air from a boiler, apparatus, or pipe in which it may be generated, stored, or conveyed.

There are two general classes of insulation for steam and hot water pipes, Asbestos and 85 per cent Magnesia. Either of these may be obtained in molded covering for pipes and some fittings, and blocks and cement. A single bill of material may include items of both these grades and characters of covering.

There is no longer any argument as to the efficacy of some kind of insulation on steam and hot water pipes. All should be covered for the savings made possible by so doing. As a general rule the covering which costs the most is the most efficient for the reason that the greatest savings are obtained with the thickest coverings.

The tables given by all the manufacturers and the findings of the A. S. M. E. research committees on the subject disclose the fact that, for the same thickness of covering, asbestos and 85 per cent magnesia are nearly equal in efficiency. This holds good with temperatures up to 400 deg. fahr., beyond which the laminated forms of asbestos coverings begin to break down. For this reason 85 per cent magnesia covering is always best for temperatures above that point to its own limit at 600 deg. fahr., beyond which for best results it is not safe to use alone. Temperatures above 600 deg. fahr., however, are not often found in steam pipes.

When we get into the high temperatures such as in smoke breeching, 85 per cent magnesia blocks, wired on the hot surfaces with an air space between the insulated surface and the insulation, should be used. There are also hair felt coverings to be used in many places either in combination with one of the other materials or alone.

When naming the kind of covering specify asbestos or 85 per cent magnesia.

The quality factor consists largely of thickness and a little study of this factor may be appropriate. Most catalogues of pipe covering manufacturers have complete tables of the efficiencies of the molded coverings they manufacture to which the reader can refer for information. They are too voluminous to reproduce here. The tables of efficiencies of blocks and sheets correspond closely with those of molded coverings, and being less voluminous than the others, are reproduced here for information on the comparative efficiencies of coverings of different thickness. For this information refer to Table 1, which is taken from the Johns-Manville general catalogue.

Although the titles of some of the coverings are "trade," yet all disclose that they are either asbestos or 85 per cent magnesia. Other manufacturers also use trade names to emphasize some special combination, but as in the case with Johns-Manville the base of the material is easy to classify under one of these kinds.

The efficiencies given in this table are the percentages of heat saved by the covering, which would be wasted if the pipes or other surface were left bare. When one notes the savings possible, there is not much argument in favor of leaving bare any surface that can be covered with one of the insulating materials.

Efficiency of Different Coverings

The very best information on the subject of insulation or pipe coverings is contained in "Transactions of the American Society of Mechanical Engineers."[2] This is an unbiased investigation of the whole subject which all the manufacturers have accepted and used in subsequent research. The manufacturers' data correspond closely with these findings although in somewhat different form. For the purpose of writing out a bill of material, Table 1 gives necessary information on which to base a decision as to kind and quality of covering to be ordered.

To the man who wishes to see the actual dollars and cents to be saved with coverings of different kinds, before he writes his specifications, a study of part of one table taken from Volume 37, A. S. M. E. Transactions will be interesting and helpful. This is Table

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[1] See previous articles on Specification Writing, in MANAGEMENT AND ADMINISTRATION, May 1924, p. 577; and July 1924, p. 83.

[2] Vol. 37, pp. 921-974 inclusive. Paper No. 1514.

TABLE 1. EFFICIENCIES OF DIFFERENT COVERINGS FOR STEAM AND HOT WATER PIPES AND FITTINGS.

THICKNESS OF INSULATION	TEMPERATURE DIFFERENCE BETWEEN HOT SURFACE AND SURROUNDING AIR.									
	ASBESTOS-SPONGE FELTED SHEETS AND BLOCKS.									
IN.	50°	100°	150°	200°	250°	300°	350°	400°	450°	500°
1..	82.90%	84.17%	85.42%	86.50%	87.50%	88.38%	89.28%	90.10%	90.92%	91.73%
1½..	87.88	88.77	89.67	90.44	91.15	91.78	92.40	92.98	93.56	94.14
2......	90.64	91.32	92.00	92.61	93.12	93.61	94.10	94.55	95.00	95.44
2½..	92.36	92.91	93.45	93.96	94.39	94.79	95.19	95.55	95.91	96.28
3..	93.74	94.02	94.49	94.90	95.25	95.59	95.92	96.23	95.54	96.85
	85 PER CENT MAGNESIA BLOCKS.									
1..	80.80%	82.35%	83.90%	85.25%	86.48%	87.60%	88.70%	89.64%	90.56%	91.48%
1½..	85.25	87.40	88.53	89.49	90.37	91.16	91.94	92.65	93.32	93.97
2..	89.32	90.16	91.08	91.85	92.53	93.12	93.71	94.27	94.80	95.31
2½..	91.19	91.95	92.69	93.32	93.87	94.38	94.87	95.31	95.73	96.14
3..	92.55	93.22	93.83	94 37	94 82	95.25	95.67	96.06	96.40	96.75
	FINE CORRUGATED ASBESTOCEL SHEETS AND BLOCKS.									
1......	80.85%	82.08%	83.29%	84.39%	85.40%	86.30%	87.22%	88.08%	88.93%	89.79%
1½....	86.29	87.20	88.09	88.85	89.56	90.21	90.86	91.56	92.06	92.67
2......	89.33	90.02	90.70	91.32	91.84	92.34	92.84	93.32	93.80	94.29
2½....	91.28	91.84	92.39	92.86	93.33	93.73	94.13	94.52	94.91	95.31
3....	92.60	93.09	93.56	93.98	94 34	94.69	95.03	95.36	95.67	95.98
	COARSE CORRUGATED ASBESTOCEL SHEETS AND BLOCKS.									
1......	79.88%	81.15%	82.43%	83.50%	84.40%	85.23%	86.05%	86.83%	87.59%	88.36%
1½....	85.62	86.49	87.36	88.12	88.79	89.37	89.96	90.51	91.05	91.59
2......	88.77	89.50	90.16	90.74	91.25	91.69	92.13	92.55	92.98	93.42
2½....	90.72	91.35	91.93	92.39	92.78	93.16	93.54	92.88	94.22	94.57
3.....	92.15	92 86	93.17	93.55	93.90	94.20	94.51	94.79	95.08	95.38

2, which is based on cost of 1000 lb. of steam at 10 cents used for 2920 hr. per year, giving the purchase price and year cost, as well as the saving per year to be expected with steam at the stated price. These figures were taken some years ago and the unit prices of both steam and covering are higher now, but this table will give a good idea of what the savings will amount to.

The table refers to 85 per cent magnesia for the reason that this kind of covering is the most serviceable in the majority of instances where covering is used, and asbestos is so near it in efficiency that either can be used as an example.

Fig. 1 gives a chart for determining proper thickness of magnesia covering to be used at any temperature, any price of steam, and any number of hours' service per year. To use it for other periods than 365 days at 24 hr. per day, multiply the price of steam at 1000 lb. by the number of hours per year the steam line is considered in use, divide by 8760 and, using the result as the price of steam on the chart, find the proper thickness.

For example, suppose that the steam pressure is 150 lb. per sq. in. gage, that it costs $0.30 per 1000 lb. generated, and that the line is in use 12 hr. per day and nine months out of the year. The number of hours per year that the steam is on is therefore 2930, or 1/3 of the time. The price of steam to be used on the chart is $\frac{\$0.30 \times 2920}{8760} = \$0.10$. The temperature of the pipe containing the steam at 150 lb. gage pressure will be about 365 deg. fahr., and assuming a room temperature of 80 deg. fahr., the temperature difference between pipe and room will be 285 deg. fahr. Now, on the chart, using the curve for steam at $0.10 per 1000 lb., the proper thickness corresponding to 285 deg. fahr. temperature difference is found to be 1.5 in. This, then, is the proper thickness for maximum net saving under the given conditions.

This chart can be used for almost any example coming within the range of conditions of any power plant with the exception of the very few which use pressures over 500 lb. gage in their operations.

Accessories

After specifying the quantity, size, kind, and quality desired in a bill of material for pipe covering there are a number of accessories to go with the covering which need to be mentioned at the same time.

Molded covering generally comes encased in 8 oz. canvas which is lapped over at the joint. This requires paste to apply to the flap, which generally comes with the order but sometimes does not. Specify enough paste with which to apply covering. Molded covering is supposed to be banded in place with metal bands, either black or brass coated, placed every 18 in. along a length of pipe. These are sometimes left out of a shipment of covering, so should be specified. There should be no extra charge for paste or bands.

It is as important to cover all flanges on a line of piping as it is to cover the pipe and fittings. To an order of pipe covering should be added the number and pipe size of flanges to be covered and specify enough of the same kind of material to cover them. If the flanges are not too large, some sections of molded covering will be sent to cut up for the flanges. This covering is cut long enough to cover the full width of the flange and extend over on each side 2 in. It is wired in place and the space between the covering on the pipe and the flange covering is filled with cement.

TABLE 2. DATA ON NET SAVINGS PER SQ. FT. AND VARIOUS THICKNESSES OF 85 PER CENT MAGNESIA COVERING FOR STEAM AT 10 CENTS PER 1000 LB.

TEMPERATURE DIFFERENCE DEG. FAHR.	THICKNESS IN.	FIRST COST OF COVERING DOLLARS	COST OF COVERING PER YEAR DOLLARS	NET SAVING PER YEAR DOLLARS
100	0.5	0.125	0.018	1.110
100	1.0	0.238	0.033	0.115
100	2.0	0.528	0.074	0.088
100	3.0	0.851	0.119	0.049
100	4.0	1.215	0.170	0.001
100	5.0	1.685	0.236	0.063
300	0.5	0.125	0.018	0.640
300	1.0	0.238	0.033	0.694
300	2.0	0.528	0.074	0.700
300	3.0	0.851	0.119	0.673
300	4.0	1.215	0.170	0.633
300	5.0	1.685	0.236	0.573
500	0.5	0.125	0.018	1.882
500	1.0	0.238	0.033	2.007
500	2.0	0.528	0.074	2.052
500	3.0	0.851	0 119	2.038
500	4.0	1.215	0.170	2 005
500	5.0	1.685	0.236	1.952

If the flanges are too large for sectional covering, blocks of the same thickness as the covering will be sent to cover the flanges. They are wired in place and all spaces filled with cement. In this instance, enough canvas will be sent to place over the flange coverings when finished. For flanges specify enough covering for a stated number and size of flanges with wire to hold it in place, together with cement to fill the spaces.

Smoke breechings or other very hot surfaces require blocks and cement. First a wire netting with spacers is placed about the breeching, the blocks are wired in place over the spacers, then cement is applied to the blocks at least 1 in. deep and brought to a smooth finish with a trowel. For such an order, one needs to give the area to be covered together with the kind of cover and quality desired. Quality means thickness, and as a guide to this on smoke breeching, magnesia blocks and cement not less than 3 in. thick, wired on over ½ in. spacers, should be required. The blocks should be at least 2 in. with 1 in. of cement.

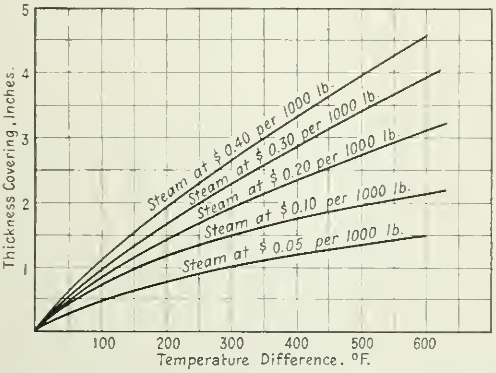

FIG. 1 CHART FOR DETERMINING PROPER THICKNESS OF MAGNESIA COVERING AT ANY TEMPERATURE, PRICE OF STEAM, AND NUMBER OF HOURS' SERVICE PER YEAR

The air space not only serves to hold many heat units in check, but avoids the possibility of breaking down of the insulating material. It should be required on all surfaces where the difference in temperature is over 600 deg. fahr.

Refrigerating Pipe Coverings

Specify quantity and size as in ordering covering for steam and hot water.

There is only one kind of this insulation and that is some form of cork. This may be either molded cork, cork board, or granulated cork, depending on the use to which it is to be put. There are four general grades or qualities, and quality means thickness here as in connection with steam and hot water. The four grades are as follows:

1. Standard brine covering, from 2 in. to 3 in. thick, is designed for brine and ammonia gas lines, and where the refrigerant ranges from 0 deg. fahr. to 25 deg. fahr.
2. Special thick brine covering, from 3 in. to 4 in. thick, is for brine lines where the refrigerant runs below 0 deg. fahr.
3. Ice-water covering, approximately 1½ in. thick, is intended for use on refrigerated drinking water, liquid ammonia, and beer lines where temperatures of 25 deg. fahr. to 45 deg. fahr. are carried.
4. Cold water covering, approximately 1 in. thick, for pipes up to and including 4 in., is for use on cold water piping to prevent sweating. For sizes larger than 4 in. use ice-water covering.

The manufacturers have a standard thickness for each one of these four grades.

There is a great variety of cork insulation coverings to meet all contingencies. They are illustrated in some manufacturers' catalogues, such as that of the Armstrong Cork and Insulation Company. Reference to their price list, of Nonpareil cork covering, will give one an idea of what he wants, its cost and weight.

In covering tanks of various kinds on refrigerating systems, cork board and granulated cork are in general use and, again, the Armstrong Company have literature (illustrated) dealing with every phase of the use of this kind of insulation. Circular tanks should be specified as to diameter and length in feet, and square tank dimensions should be given as to length, breadth, and height, in order that the square feet of covering may be estimated.

Varying thicknesses of covering for tanks are allowed with a minimum as well as a maximum beyond which it is not necessary to go. The advice of the manufacturer should be followed as to thickness, as he only gives this for best results irrespective of the gross receipts on a sale.

Miscellaneous Material

The necessary material to apply cork insulation should come with each order without additional expense to the purchaser, but in filling out the bill of material the following should be specified:

1. Waterproof cement for joints.
2. Copper clad steel wire, for holding the covering in place.
3. Brine putty, for filling spaces between the covering and the pipe or fittings.
4. Steam filler, for smoothing up seams and chipped edges.
5. Asphaltic paint, for painting the outside of the covering to give a neat appearance.
6. Sheet iron shields, for protecting the covering from the hangers for the line. These shields must be shaped to fit the covering and extend 4 in. on each side of the hanger.

In laying out pipe lines, ample space should be allowed to permit the application of covering of proper thickness in conformity with the distances given in Table 3. These are the minimum distances to allow for covering, and consider the fact that the supply and return lines are often necessarily laid out parallel and on the same level.

Where pipe lines are too close together to permit the use of regular size cork covering, the pipes should be covered with regular covering on the outside halves with a cork center between. In this case, the actual distance between the parallel lines must be given.

Where the pipe lines are too close to walls or other surfaces to permit the use of the regular size covering the pipe should be covered with the regular size on the outside and cork center between the pipe and wall or other surface. The cork center must completely fill the space between the pipe and wall. In this event, the distance between the pipe center next the wall, and the wall itself, should be given.

TABLE 3. SPACING OF PIPE LINES.

STANDARD BRINE COVERINGS	SPACE REQUIRED BETWEEN PARALLEL PIPES IN.	SPACE REQUIRED BETWEEN PIPES AND ADJACENT SURFACES IN.
Screwed fittings up to and including 6 in..	8	6
Screwed fittings larger than 6 in..........	14	8
Flanged fittings........................	14	8
SPECIAL THICK BRINE COVERING		
Screwed fittings up to and including 3 in..	10	8
Screwed fittings above 3 in..............	18	12
Flanged fittings........................	18	12
ICE-WATER COVERING		
Screwed fittings up to and including 6 in..	6	4
Screwed fittings above 6 in..............	10	5
Flanged fittings......................	10	5
COLD-WATER COVERING		
Screwed fittings up to and including 4 in..	4	2½
Screwed fittings above 4 in..............	10	5
Flanged fittings........................	10	5

In applying cork covering to pipes, the joints should be broken. Cork covering should never be applied until the lines and apparatus have been tested and made tight. All surfaces to be insulated must be perfectly dry and free from frost and foreign matter. All spaces between fittings and fitting covers must be filled with brine putty.

Waterproof cement must be used on all lateral and end joints. All joints must be butted together tightly. The covering must be secured in place with copper clad steel wire using not less than six wires to a section of pipe covering and four wires to each fitting. All pipe hangers must be carried on the outside of the covering, which must be protected by a sheet iron shield. Proper fitting covers for each fitting must be provided. All seams and chipped edges in the covering and fitting covers should be filled with seam filler so as to leave a smooth surface. The outside surfaces of all covering should receive one good coat of asphaltic paint.

Unless the owner has competent help to apply any kind of covering it is well to specify that it be done by the manufacturer of the covering.

A bill of materials for pipe covering might be written as follows:

REQUIRED—

500 ft.—6 in., 85 per cent Magnesia, molded covering, 1½ in. thick.
5—6 in., 85 per cent Magnesia, molded T fittings, 1½ in. thick.
10—6 in., 85 per cent Magnesia, molded L fittings, 1½ in. thick.
85 per cent Magnesia, cover for 15—6 in. flanges, 1½ in. thick.
Flanges and fittings to be covered, standard weight.
85 per cent Magnesia cement to fill around the above flange covers.
Black bands for the pipe cover.
Paste to apply this amount of pipe cover, and number of fittings.

If a smoke breeching which is 12 ft. long by 6 ft. across one way and 4 ft. the other is to be covered, write the bill of material as follows:

REQUIRED—

Cover for 240 sq. ft. of smoke breeching, made up as follows:
240 sq. ft., chicken wire netting with ½ in. spacers.
240 sq. ft., 85 per cent Magnesia block, 6 x 36 x 2 in. thick.
240 sq. ft., 85 per cent Magnesia cement, 1 in. thick.
Blocks to be wired on over-spacers with T hooks.
Furnish wire and hooks.

For a refrigerating plant write a bill of material as follows for the cork covering.

REQUIRED:

500 ft. Standard brine covering, 2 in. thick, for 2 in. standard pipe and screw fittings, spaced 8 in. centers.
100 ft. Standard brine center cover, for 2 in. standard pipe, spaced 4 in. centers.
500 ft. Special thick brine covering, 3 in. thick, for 3 in. standard pipe and screw fittings, spaced 10 in. centers.
100 ft. Special thick brine center cover, for 3 in. standard pipe spaced 8 in. centers.
500 ft. Ice-water covering, 1½ in. thick, for 1½ in. standard pipe and screw fittings, spaced 6 in. centers.
100 ft. Ice-water center cover, for 1½ in. standard pipe, spaced 4 in. centers.
10—2 in. Standard brine T covers.
10—3 in. Special thick brine T covers.
10—1½ in. Ice-water T covers.
10—2 in. Standard brine L covers.
10—3 in. Special thick brine L covers.
10—1½ in. Ice-water T covers.

For the above:

Water-proof cement, for all joints.
Copper clad steel wire, to fasten all pipe and fitting covers.
Brine putty, to fill spaces.
Seam filler, to smooth seams and edges.
Asphalt paint, to coat the covering at finish.
Sheet iron shields, to protect covering at hangers.

Analyzing Statements of Operating Results

By GEORGE S. CREMER and WILLIAM R. DRACHBAR

THE industrial accountant is called upon at regular periods to prepare statements of operating results. The process of analyzing these ordinarily proceeds by steps, and the number of steps to be taken depends upon the depth and extent of the analysis required.

For example, an increase or decrease in net income may be caused by: (1) Increase or decrease in revenue from sales; (2) Decrease or increase in cost of goods sold.

Analysis may end here, or it may go further and show the amount of increase or decrease in revenue from sales which was due to: (1) Increase or decrease in number of sales; (2) Increase or decrease in average amount of individual sales; (3) Increase or decrease in average price received.

Here again, analysis may stop, or it may continue and show how much of the increase or decrease in quality sold was due to: (1) Increase or decrease in demand; (2) Increase or decrease in production; (3) Special efforts to effect sales.

It may show how much of the increase or decrease in average prices received resulted from: (1) A general change in prices; (2) Changes in prices of certain specific lines; (3) Changes in class of customers (if large buyers received goods at lower prices).

The method of analysis to be used is to isolate all of the several causes of variation which can be identified, and first to measure the effect of each one separately, assuming for the purposes of the computation that it is the only cause of variation which exists, then combine the several separate effects and prove that the entire amount of variation is accounted for.

Index Number

657.524 Cost Analysis

Changes in the cost of raw material used in production may be due to changes in:

1. Quantities of material used, caused by:
    - (*a*) Quantities of goods produced.
        1. To fill orders.
        2. To add to stock of goods on hand.
    - (*b*) Quantities of materials used per unit produced, due to changes in:
        1. Formula or method of manufacture.
        2. Efficiency in operation of plant.
    - (*c*) Quality or purity of materials used.
2. Prices of materials used, caused by:
    - (*a*) Market fluctuations.
    - (*b*) Quality of materials purchased.
    - (*c*) Quantities in which materials are purchased.
    - (*d*) Terms of credit.

We may take for an illustration a calculation showing the causes of an increase in the cost of tallow used

ANALYSIS OF CHANGES IN MATERIAL COSTS

Kind of Material	Quantities Used			Quantities Used per Unit Produced			Cost of Materials Used			Average Prices of Materials Used			Changes in Total Cost Due to Changes in:		
	This Year	Last Year	Change	This Year	Last Year	Change	This Year	Last Year	Change	This Year	Last Year	Change	Quantity Produced	Quantity Used per Unit Produced	Average Prices

Fig. 1 Analysis Form for Changes in Material Costs

ANALYSIS OF CHANGES IN LABOR COSTS

Classification	Number of Man-Hours			Number of Man-Hours per Unit Produced			Cost of Labor			Average Wage Rate per Hour			Change in Cost Due to Changes in:		
	This Year	Last Year	Change	This Year	Last Year	Change	This Year	Last Year	Change	This Year	Last Year	Change	Quantity Produced	Number of Man-Hours per Unit Produced	Average Rate of Wages

Fig. 2 Analysis Form for Changes in Labor Costs

ANALYSIS OF CHANGES IN REVENUES FROM SALES

CLASSIFICATION	NUMBER OF UNITS SOLD			NUMBER OF UNITS SOLD PER CUSTOMER			AMOUNT OF REVENUE			AVERAGE PRICE RECEIVED PER UNIT SOLD			CHANGES IN REVENUE DUE TO CHANGES IN:		
	This Year	Last Year	Change	This Year	Last Year	Change	This Year	Last Year	Change	This Year	Last Year	Change	Number of Customers	Number of Units Sold per Customer	Average Price Received per Unit

FIG. 3 ANALYSIS FORM FOR CHANGES IN REVENUES FROM SALES

in the manufacture of soap. The quantity used was:

This year, 1,500,000 lb., to produce 1,750,000 units, an average of	0.857143 lb. per unit
Last year, 1,250,000 lb., to produce 1,450,000 units, an average of	0.862069 lb. per unit
Increase, 250,000 lb. Increase, 300,000 units, or 20.6897 per cent.	0.004926 Decrease

The cost of tallow used was:

This year	$75,000	from which we compute an average price of	$0.05 per lb.
Last year	68,750	from which we compute an average price of	0 055 per lb.
Increase	$6,250	Decrease	$0.005

From these basic figures we compute the effects of these separate causes of variation, each of which might be further subdivided if necessary (See Fig. 1 for form of summary):

Increase in cost due to increase in production—$68,750 × 20.6897 per cent		$14,224.17
Decrease due to change in quantity used per unit of production, being 1,750,000 × 0.004926—8,620.5 lb. of tallow at last year's price, $0 055	*$474.17*	
Decrease due to change in average price—1,500,000 lb. at $0.005	*7,500.00*	
		$7,974.17
Net increase in cost of tallow used		$6,250.00

Italic figures show decrease.

The effects of several contributory causes of a variation in labor cost can be determined in a similar way by the use of a few basic figures obtained from records which no manufacturer would be without:

This year,	50,000 man-hr. at an average cost of	$0.50	per man-hr. cost	$25,000
Last year,	48,000 man-hr. at an average cost of	0.47	per man-hr. cost	22,560
Increase	2,000	$0.03		$2,440

resulting in a production of:

This year	1,750,000 units, and an average per unit of	0.0285714 man-hr.
Last year	1,150,000 units, and an average per unit of	0.0331034 man-hr.
Increase	300,000 units or 20.6897 per cent. Decrease	0.0045320 man-hr.

The causes of the increases in the cost of labor are then shown to be: (See Fig. 2 for form of summary):

Increase in cost due to increase in production— $22,560.00 × 20 6897 per cent		$1,667.60
Decrease due to change in number of man-hr. per unit of production being 1,750,000 × 0.004532 = 7,931 man-hr. at last year's price of $0.47	*$3,727.60*	
Increase due to change in average wage—50,000 × $0.03	1,500.00	
		2,227.60
Net increase in cost of labor		*$2,440.00*

Italic figures show decrease.

Variations in the amount of revenue received from sales may be also studied through a similar computation. Assume that sales figures on one product were:

This year	10,000 units sold at an average price of	$15.00000	realized	$150,000
Last year	10,360 units sold at an average price of	15.92664	realized	165,000
Decrease	360 units or 3.4749 per cent Decrease	0.92664	Decrease	$15,000

There were:

This year	5000 customers, who purchased an average of	2.0000000	units each.
Last year	5200 customers, who purchased an average of	1.9923077	units each.
Decrease	200 customers Increase	0.0076923	units

The computation follows (See Fig. 3 for form):

Decrease in revenue due to decrease in number of customers 200 customers × 1.9923077—at last year's price per unit ($15.92664)		*$6,346.16*
Decrease in revenue due to decrease in average number of units sold to each customer, 5000 customers × 0.0076923 (average sales per customer)—38.4615 sales × $15.92664 (last year's average price)	$612.56	
Decrease in revenue due to decrease in average price received. 10,000 units sold × $0.92664 (decrease in average price received)	*9,266.40*	
		8,653.84
Net decrease in revenues		*$15,000.00*

Italic figures show decrease.

The methods of analysis which we have described are not intended nor advised for ordinary use. But when there is need for accurate interpretation of results, it will be found that its difficulty is far less than one would suppose.

The usefulness of deep-cutting statistical analysis is unlimited in its possibilities. A few are listed:

1. The primary use is to compare changes in costs occurring since the preceding period.
2. Changes in unit costs may be analyzed along the same lines, after the money changes have been allocated.
3. Differences in operating results of different establishments for the same period may be traced in exactly the same way as differences in operating results of the same establishment for different periods.
4. Actual results may be accurately compared with estimates previously made.
5. The probable effects of contemplated changes in policy may be determined before the changes are made.
6. It is possible to isolate the results of one portion of operations, as for example, to study production costs with and without by-products.
7. Estimates of future costs based on probable demand, material costs, and labor costs, can be made in a way which gives due weight to each factor.

Cutting Manufacturing Costs By Means of the Oxy-Acetylene Blowpipe

Examples of Work in Which It Is a Standard Production Tool

By GEORGE E. HAGEMANN

Associate Editor, MANAGEMENT AND ADMINISTRATION

IN the past few years the art of welding has been developed to such high degree that it occupies an important place in many plants as one of the regular production operations. Originally it was employed in work where manufacturers felt that they needed merely a light bond to hold parts together. As the possibility became evident of using the oxy-acetylene blowpipe for jobs where a strength equal to the original metal was necessary, and also for purposes of making cuts in all sorts of metal, the operations of welding and cutting received recognition as part of the standard processes of manufacturing in a large number of industries. It is the purpose of this article to explain a few of the hundreds of instances on record where welding and cutting are part of the regular daily routine of production.[1]

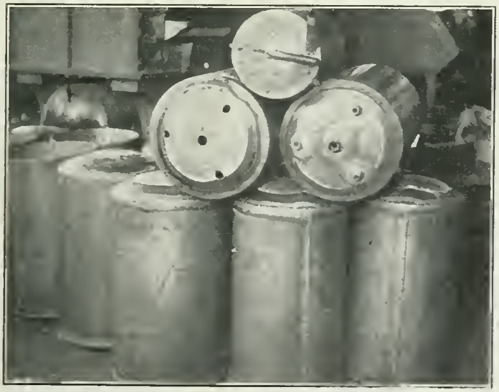

FIG. 1 STEEL TANKS PRODUCED ENTIRELY BY WELDING

Steel, in the form of sheets or plates, is a material which lends itself readily to welding operations. Formerly riveting, soldering, brazing, and folding were the main methods of making joints in products turned out from this metal. But the art of welding now makes it possible to unite parts, insert heads, attach connections, even of other metals, and produce jobs as strong as the sheets or plates themselves, if not stronger. In addition, the leakage trouble which practically always develops sooner or later with a riveted joint, especially where corrosive action occurs, is eliminated, as the two parts are to all intents and purposes one piece. This is very often the determining factor in selecting welding as the method of making a joint. (Figs. 1 and 2).

Index Number
665.882 Oxy-acetylene welding

The construction of ammonia tanks offers a good example of oxy-acetylene welding on steel plate. One large manufacturing concern makes these tanks with a body 4 ft. long, 20 in. inside diameter, and $\frac{3}{8}$ in. thick. A dished and flanged head of $\frac{3}{8}$ in. metal is inserted at each end to the depth of 1 in. The extending part of the shell is heated with the blowpipe, flanged over the head and welded fast. The flanging operation takes two hours and the welding operation four hours on the two heads, while the oxygen consumption is about 330 cu. ft., and 5 lb. of $\frac{1}{4}$ in. welding rod are used.

The fittings are also welded on the tank. These consist of two 8 in. nipples and two hanging lugs, a $\frac{1}{2}$ in. gage connection, and a 2 in. drain. The total welding cost per tank is $9\frac{1}{2}$ hr. time, oxygen consumption 500 cu. ft., acetylene 470 cu. ft., and welding rod 9 lb. No figures are available to compare the actual riveting process with these costs, but all expense of laying out, punching, and reaming holes is saved.

Several concerns have successfully adopted welding of steel window sash and door frames as a regular production operation. Jigs are necessary to hold the parts in place so that the finished welded product will be exactly correct in size and shape. Jigs also increase output and standardize the product, thus reducing costs. The expense of making these jigs is slight and their use is amply justified. Fig. 3 shows a section of the welding department in one of these plants. The material is supplied to the welders from racks at the left of the picture, is assembled by blow-

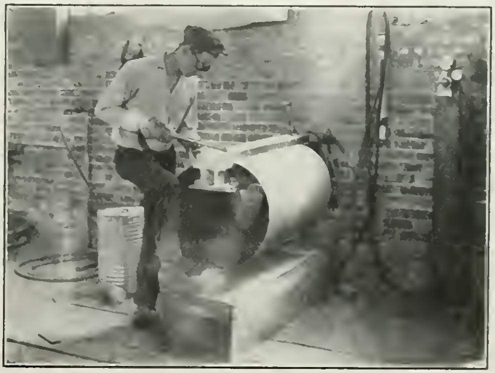

FIG. 2 WELDING A LONGITUDINAL SEAM

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[1] Data and photographs for this article were furnished by courtesy of The Linde Air Products Company.

pipes on the benches shown in the center, and then is delivered to cranes at the right in the main bay for finishing and painting operations.

Another interesting application of oxy-acetylene welding to sheet metal is found in the making of sugar mold pans, Fig. 4, from 16-gage galvanized sheets. The bottoms of these pans were 34 by 14 in., the height 6 in., and the sides and ends were formed outward on an angle of 70 deg. This made the dimensions of the tops of the pans 36 by 16 in. There was a butt weld at each of the four corners of the pans.

The final arrangement adopted for this work was to place the pans on a revolving table at which the operator sat. All four corners of the pans were first clamped, and as each was welded the table was moved around to bring the next one into position. Production was at the rate of 100 to 120 pans welded per day, and the estimated cost of gas consumption per pan was less than four cents.

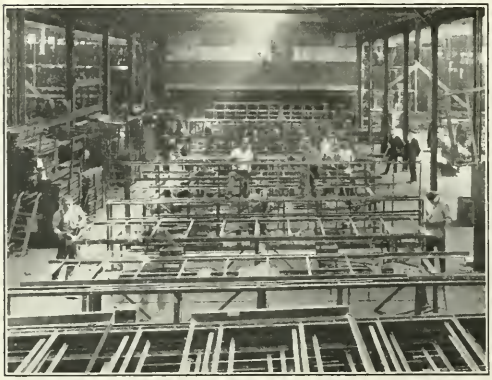

FIG. 3 WELDING DEPARTMENT IN A LARGE STEEL SASH AND DOOR PLANT

The insides of these pans had to be soldered in the corners according to the customer's specifications. This opened up a novel opportunity to make the heat from the blowpipe do double duty. Solder was applied while the corners were hot after welding, and the sealing operation was performed quickly and successfully. In addition, it saved a lot of money, for 5000 pans were on the order.

Steam separators are successfully made as a production operation by the use of the welding blowpipe. One concern has made such separators 3 ft. 6 in. high, 2 ft. 6 in. in diameter, constructed of ½ in. plate with a longitudinal seam butt welded. The heads are convex and are flanged and butt-welded to the body of the tank. An 8 in. hole is cut in the top and a flange for an 8 in. pipe is welded on around this hole. The bottom head is similarly fitted for the attachment of an 8 in. pipe. The baffle plate is held in position by 4 lugs welded to the inside of the separator about 6 in. from the bottom. A ½ in. nipple is welded to the bottom for a drain and two screwed connections are welded on the side for a gage.

The cost of welding each separator on the particular job studied was $41.86. The contrast with cast iron separators is striking—in weight and in total cost. Moreover, welding offers the opportunity to make special designs promptly and without the necessity of expensive pattern, foundry, and machine work.

Fig. 5 shows the use of the oxy-acetylene blowpipe in making automobile fenders.

Steel is not the only metal to which welding can be applied. It has been successfully adopted for a number of other materials. In one plant 1/32 in. brass sheet is employed to make loud speakers for radios, and two seams are welded with silver solder. City gas and air had previously been utilized for this work and each job took about 6 min. The use of an oxy-acetylene blowpipe cut this welding time down to 4 min. and resulted in a neater job.

Another concern has successfully applied the welding process to bronze headers that were to be fastened to steel pipe. This apparatus was to be used on hot water feed lines. The headers consisted of 2 in. bronze pipe with ¾ in. and 1 in. nipples welded in. Tobin bronze welding rods were used and the welds were built up to a somewhat greater thickness than in the case of steel. After the welding was done the headers were polished up and made a very neat appearance.

Still another use of the oxy-acetylene blowpipe for welding of bronze is found in the making of cylinders. These in one case were made of ⅝ in. sheet bronze and were 32 in. in diameter and 22 ft. long. The circular seams as well as the longitudinal seams were welded with perfect satisfaction.

Aluminum, copper and lead products offer exceptionally good opportunities to apply welding to production work. Fig. 6 shows a view of a plant engaged in the manufacture of aluminum parts for airplanes. The gasoline tanks in the foreground are constructed of aluminum sheets, welded throughout, including the attachment of all fittings. The baffle plates in these tanks are held in place by studs which project through the casing and are welded, not merely riveted, to it by the blowpipe.

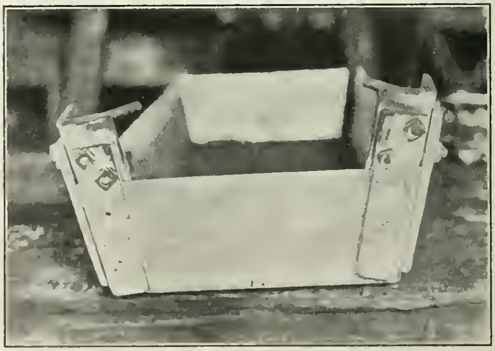

FIG. 4 SUGAR PAN MADE BY WELDING GALVANIZED SHEETS
Corners of these pans were soldered by using residual heat.

Fig. 7 illustrates the welding of a lead fitting. Lead is a metal which yields readily to the blowpipe. Any desired product can be made with the greatest facility

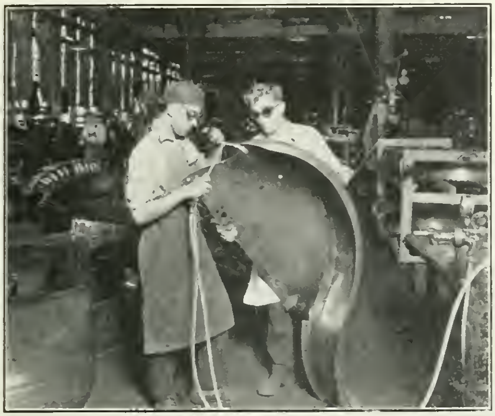

FIG. 5 WELDING STEEL AUTOMOBILE FENDERS

from this material by means of welding appliances. In fact, the first autogenous welding was done with this metal.

The oxy-acetylene blowpipe is used very extensively for cutting in connection with production work. One concern cuts rings from steel plate ½ in. to 2 in. in thickness by means of a blowpipe. The circles vary from 4 in. to 30 in. in diameter. In the shipbuilding industry hull plates are often cut to shape by the oxy-acetylene flame. In some cases it is necessary to bend such plates to unusual shapes. These shapes cannot be formed on ordinary presses and it does not pay to build special machinery for the purpose. By heating the metal at the points where bending must be done it is softened so that the proper shape may be formed by the use of sledges.

Fig. 8 shows the cutting of 8 in. steel plates to form a ship's rudder. The blowpipe is mounted on a straight line machine. By turning the handles on the drive, the flame is moved in any desired direction with precision and at a cutting speed to suit the requirements of the particular quality of metal under fabrication.

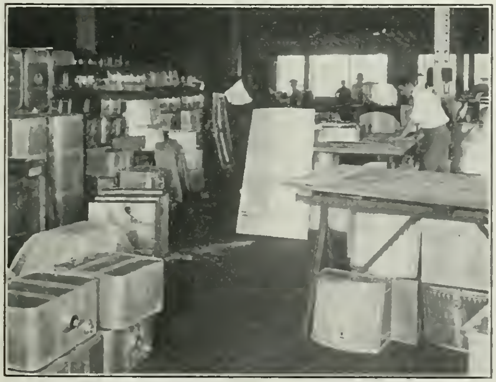

FIG. 6 ALUMINUM AIRPLANE PARTS MADE ENTIRELY BY WELDING

A manufacturer of special truck bodies employs a cutting unit for shortening frames and for cutting special braces from angle and channel iron. All rivet and bolt holes are pierced with the blowpipe instead of being drilled. They are then reamed to size. This firm also cuts out rivets from braces and frame ends and uses the blowpipe for heating rivets. The products involved are special dumping bodies, garbage bodies, roll bodies for lumber handling, special cabs, and derrick and hoisting apparatus which is mounted on trucks.

The welding and cutting blowpipes have been used with great success on cast iron. Some of these applications have been on repair jobs to mend broken castings. But the process plays an important part in production work as well. Fig. 9 shows cast iron manifolds built by welding. In every foundry some castings are certain to be spoiled. In some cases blow holes or sand holes will develop. In other cases the metal will not fill out completely in the mold, leaving a gap or an incomplete projection of some kind. "Burning in" of metal is not as a rule a satisfactory process for the repair of such defects. It is especially objectionable to attempt when a lug or some other portion has to be built up, and in fact only rarely accomplishes the purpose. Welding is far better.

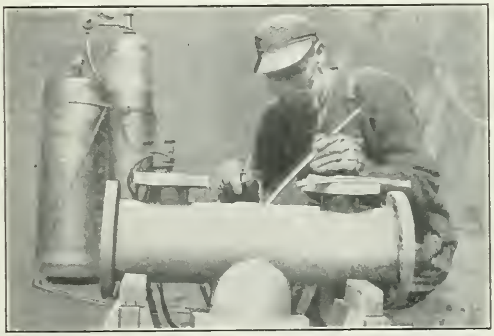

FIG. 7 WELDING A LEAD FITTING BY THE OXY-ACETYLENE BLOWPIPE

One of the outstanding examples of such an application is found in large automobile plants where conveyor processing and assembling are utilized. Castings in one of these plants are put on conveyors as soon as poured, and, as they go from operation to operation, are assembled into unit groups. Inspection must therefore be made on these castings while in transit, to remove those that are defective.

These defective castings are neither scrapped nor sent to a central storeroom to be later reclaimed, but are repaired at once. For instance, cylinder blocks that are not perfect are shunted off to a separate conveyor and run slowly through a preheating furnace which holds 20 at a time. As they come out, helpers move them with tongs to the welding platform, where blow holes and other imperfections are filled up. Then the castings are run by conveyor through an annealing furnace to soften the metal for machining. From this point they are delivered again to the main conveyor, from which they have been absent only 15 min.

The 118 welders in this plant work in shifts and in gangs. Tanks of oxygen and acetylene are located on the floor above. Pressures have been standardized for each kind of work, and signals are arranged so that each operator can let the tank attendant know when the pressure must be altered, or tanks replaced.

One of the manufacturers of steam turbines has utilized welding with satisfactory results in his plant to reclaim bottom cases for turbines that have developed blow holes in the casting, or that have been broken in moving through the plant. These defects are repaired by the welding blowpipe and the weld has proved fully as strong as the metal in the other portions of the casting.

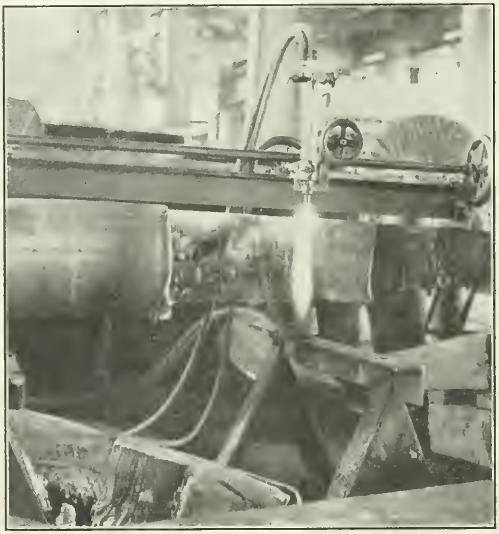

FIG. 8 CUTTING 8 IN. STEEL PLATE TO FORM A RUDDER

In this plant also the corners of the flanges on turbine casings are cast a foot larger than the finished size. The extra material on these corners is used to clamp the case to the milling machine, and after the machining is done it is necessary to remove it. Formerly this was done by drilling and then chipping off the metal to the proper size. In some cases a milling cutter or saw has been more profitably employed. The cutting blowpipe is now used to remove this excess metal, which it does much more quickly and at a much lower cost than by any other method.

Monel metal parts used for governor valves on turbines are also reclaimed, when broken, by this same plant. It was formerly the practice to rivet the brass strainers used in this valve. On account of the thin metal in these strainers welding at first was not thought possible. However, by using a special welding rod which would melt readily and make the attachment quickly, it was found possible to apply welding successfully at an appreciable saving in cost.

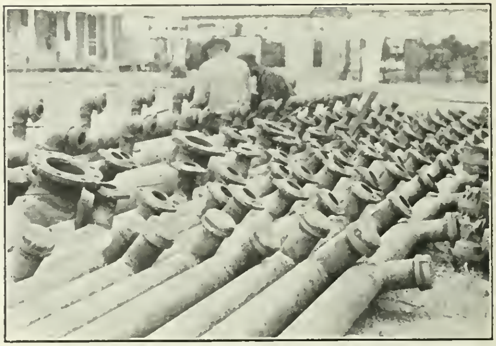

FIG. 9 CAST IRON MANIFOLDS BUILT BY WELDING

Another foundry operation in which the cutting blowpipe finds application is in the removing of risers from castings. (See Fig. 10). Formerly this work was done with a chipping hammer, or saw, or, if the riser could be partially knocked off with a sledge, it was necessary to smooth the surface with a chipping hammer. It is possible to cut off these risers very quickly and cleanly by using the oxy-acetylene blowpipe. The cost is also appreciably less than when the chipping method is used.

Where a large number of risers of various thicknesses are to be removed, the best practice is to separate castings into groups according to riser sizes. An operator with the correct size of cutting nozzle can be assigned to each group, which is more economical than to cut off small risers with a large blowpipe, and vice versa.

Cutting off of risers is extremely important in steel castings. Owing to the ease with which the blowpipe can reach into inaccessible places, risers and sink heads can now be placed where they do the most good for the casting, rather than where they can be reached easiest with a saw or machine tool. This possibility has enabled some foundries to revolutionize their molding practice, with excellent results on quality of products.

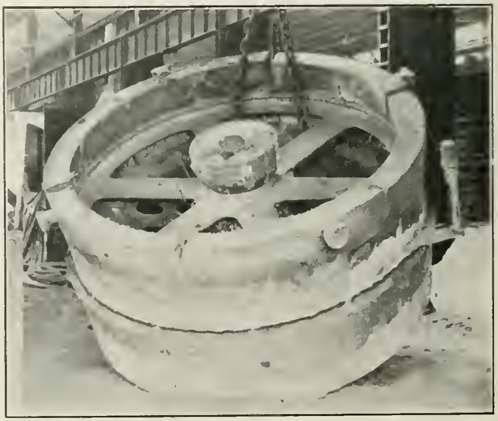

FIG. 10 RISER ON THIS 12 FT., 40,000 LB. GEAR CASTING WAS CUT OFF BY THE OXY-ACETYLENE BLOWPIPE

Organization for Successful Operation

Work of the Industrial Executive

By B. A. FRANKLIN

Vice-President, Strathmore Paper Company

UNDOUBTEDLY the most important element in industry is organization, and it is natural that it should be so. As long as men accomplished things, and produced singly, individual skill and ability were the supreme industrial qualities, and, while they made for independence in a small way, they never advanced production nor amassed great fortunes. They supplied no wide consuming public, and built up no great demand. For it must be remembered that in the beginning demand is almost always built by supply, and only after supply has thoroughly created demand does it follow demand.

Industry in its present form took a long time to grow. It was offered no incentive under feudal, or completely autocratic, governments. Organizing knowledge and ability, of course, have existed for centuries, but exercised their talents mostly in government and military forms. Outside of shipbuilding and possibly one or two other lines, where groups were essential to production, organization ability took little notice of industry because it had no sufficient incentive.

Invention was one of the first fruits of a wider freedom and gradually organizing ability was incited to take hold of industry through the opportunities which it presented, since, in fact, in the earlier days of growing democracy in the world it had little other opportunity. It is organization, and the right to the results of effort, which have made industry the great proposition it is today. It has fostered invention, and while it has not been directly responsible for specialization, which was the natural outcome of the invention of single purpose machinery, it has naturally expanded and utilized it to the limit.

Organization is the assembling and co-ordination of parts to form an operating unit. The better this assembling and co-ordinating is done the more effectively the unit operates and the more surely are adequate results obtained. In the present article Mr. Franklin discusses the important requirements to be met, and the methods to be followed for the upbuilding of a smoothly operating and result-getting organization.

The Place of Organization

In the industrial unit, organization is the supreme need because it is the most important factor making for progress, production, and success. In the small unit one man of ability and energy may in himself in effect be the whole organization, performing all the essential functions of organization; of buying and selling, of planning and devising, of directing and disposing. This was indeed the early history of industry, as it was the origin of early industry.

Index Number
658.16 Organization
658.1 Executive control

As the industrial unit became larger it was necessary for the one man of ability to delegate organization functions to others, to depend upon others to accomplish parts of organization work. As it became greater and greater this necessity was expanded until we have arrived today at a point where the chief executive may not even have the ability to perform many of the organization functions or even most of them, despite which lack he may operate a very large unit with great success provided he possesses organization ability—the ability to decide, direct, and inspire.

All of this is very simple, and might be of no particular significance if the industrial unit be considered a piece of purely private property whose fortunes may vary, as do those of private ownership. If, however, the industrial unit be considered as a service center, and consequently of definite moment in the community and in the lives of many people; and if, for the value to the general public, its most effective operation be important, then in view of the fact that very many units observably do fail in this respect of organization, it seems a matter of the greatest importance, for continued success depends to a very great extent on good organization.

Elements of Industrial Success

The first element of success in an industrial unit is not ownership, although in the minds of many this seems to be taken for granted. If the successful units are analyzed it will be found that there is first a definite comprehension and a sensitiveness to public demand. The Ford Company is of course an outstanding example, where the idea that the public would buy in great quantities a cheap and serviceable machine was adhered to intelligently till it brought tremendous results.

The second element, of course, is the development of a plan to put the idea into effect. The third element following in natural sequence, is the development of an organization to carry out the plan.

It is somewhat astonishing occasionally, when consideration is given to the progress of certain industrial units, to observe that the executive is entirely unconscious of two facts, the knowledge of which is fundamental to industrial growth and success, and the use of which has made many fine executives and many fortunes. The first of these is that the industrial unit is very essentially and fundamentally a group center of co-operation of all of the abilities possessed by the co-operators. The second is a tenet of scientific management, viz., that their knowledge and ability should be gathered and utilized.

The Matter of Understudies

It is of course more or less natural for men of energy and force, and especially of proved ability, to operate on the one-man plan because of their very nature. But when as time goes on, and other interests intervene, their expressed desire—"I wish I had someone with my ability to take my place," can only be answered, and truly, with the reply—"Why didn't you train someone in your organization to do it?" This is the cry for organization.

Such concerns, of which there are a great many, are one-man concerns, which, with ability on the part of the one man, may succeed until that ability disappears, and they then become failures. The remedy, of course, is organization which abets the ability of the one man or may make up for the lack. No industrial executive has either the right, when the industrial unit is considered from the broad point of view, or should have the folly to smother by rebuff or indifference, the ideas and growth of subordinates. The wise executive makes his people grow by the encouragement and careful consideration of their ideas.

A good organization must of necessity include men of brains, energy, concentration, and ability for hard work, and while of course the first two are important, the possession by a group of reasonable intelligence, of the two latter qualities will carry farther than the first two without the latter. A necessary element which must display itself in the building of an organization is therefore selection, and herein lies the first quality of an industrial executive. It will be remembered that Andrew Carnegie ascribed his own large success very greatly to his ability in this direction.

As to the method of selection there unquestionably is a considerable need of education among industrial executives. There are those who deliberately seek good men, applying to colleges and other sources of man-supply. Some units endeavor to obtain the experienced men of their competitors. Very largely, however, executives depend upon the chance discovery and application of new material.

Psychology is developing certain tests which are good as general guides in the selection of subordinates—good at least to indicate the possession of certain valuable traits. Perhaps, though, these tests, in a complicated and unmeasurable quantitative but "developable" relation of essential qualities, can as yet only serve as guides. Many executives depend on impressions of personality made by interviews. The wise executive will make no mistake in interviewing every applicant for an organization position, since thus he may now and then make a real find.

Organization Policies as to Promotion

If analysis is made of many successful organizations it will be found that the key men are men who have generally been with the unit from almost the beginning of their careers, and that there exists a definite policy of taking on likely young men and placing them in any position which may offer itself at the time with the idea of observing them and developing them to meet the organization needs. If older men are brought from the outside to fill the more important positions it is because of the possession of some particular knowledge not possessed by those already in the organization. Speaking generally, there must be a policy of adhering as strictly to promotion as possible, if the younger men are to have faith and loyalty in the value of their development and opportunity. Nothing discourages or destroys the loyalty of young men of ability so much as to find their advancement suddenly shut off by outside entries. The industrial executive will, generally, make no mistake if he adheres pretty firmly to: first, the policy of internal promotion; and second, inside the organization, to the promotion of the most able man.

The Selection of Men

There often arises the question as to the comparative value of college men and men who employ this same period in getting practical experience. Opinions vary on this point, but it seems generally true that of two men of given ability, the training of the college man will eventually put him farther ahead—at least it will if he does not become impressed with the idea that his college training alone puts him above the drudgery involved in getting the practical experience he must have.

Of course, the selection of the elements of an organization is directly affected by the requirements of the work to be done—the various departmental functions of planning, of process knowledge, of research, of cost and accountancy, of production, of engineering, of clerical labors, of advertising and selling, and of general executive ability. The choice of men to perform these functions must be made with three considerations in mind—temperament, tendency, and knowledge, for it very often happens that even with knowledge a man without the temperament and tendency accomplishes poorly. The good accountant may make a poor executive, the good clerk is often spoiled by promotion, the good executive may make a poor engineer.

Industrial unit success must always depend on directed co-operation, for under any conditions the industrial unit is nothing but a center of co-operation. The quality of the direction must be the important element in its success and the executive organization provides that direction. Selection must therefore be a great element in its upbuilding. With men of brains, of energy, of initiative, of vision, of courage, of concentration and application, great units have been built even with small initial capital. America is studded with them.

Training the Organization

It follows automatically that the next important element in organization after selection is training. The new member, if experienced, must either learn the ideals, aims, and methods of the organization and fit himself to them, or undertake to bring the other members of the organization to understand and co-operate on his own. The new member, if inexperienced, stands on the threshold of a career of which he knows nothing. His abilities must be given something definite to develop upon, and they must be trained along definite lines if he is to fit into the scheme of maximum unit co-operation. It frequently happens that men of ability become discouraged in one concern by what they term lack of opportunity—not because of failure of promotion which must, generally, in a single unit, come slowly, but because no sense of direction is given to their abilities and no assistance in their general development. The same men may succeed in another concern where they find this direction and interest.

The usual man wants hope and improvement more than he wants immediate promotion. He will wait and work for the latter if supplied with the former. Since the best organization is always the growing one, where the younger men are pushing along behind the older ones with ideas, suggestions, and the urge for improvement, the importance of the proper development of the members of his organization by the industrial executive cannot be overrated. Training, education, discipline, and inspiration will accomplish this development.

In considering the application of these, two things may well be taken in mind. The first of these is that if the body is the industrial unit, the spirit is the executive organization, and upon its maximum animation depends the success of the body. The second important thing is that the industrial executive, in the members of his organization, will find men eager to learn, anxious to know how, willing to discipline, eager for inspiration, desirous of results. If they are not there he needs a new organization. His task, therefore, is mainly to find practical methods of training and developing these on-coming men.

Improving the System and Service

There are certain things which are needed in every industrial unit beyond the carrying on of routine.

One of these necessities is the constant improving of the system and service of the department. Presumably the department head should be capable of looking after this, but in the working out of the two ideas of bringing along all members of the organization for better work and promotion, and the working out of the co-operative idea whereby the best ideas of all are obtained, there should be developed some systematic plan of discussing better ways and of deciding what changes are to be made and how to make them.

One concern has handled this proposition with success for a number of years by establishing regular departmental meetings at which all of the department organization are present, and often representatives of interlocking departments. All discussion is open; everyone is asked his opinion, and in turn requested to bring up any matters or suggestions in his mind. There is a chairman and secretary, and all discussion and decisions are recorded, and a copy sent to everyone concerned including the executives.

It will be seen that this plan brings out the ideas of everyone and reaches some decision on them after discussion. Each one, besides learning the aims, the needs, the methods, the difficulties of the department, has an opportunity to help solve them, and since the minutes come before the executives, knows that his ideas are brought to the front. In technical and engineering matters, in statistical and service matters, thorough discussion not only brings out the best but gets immediately, from the very nature of the decision, maximum co-operation. Each man feels himself part of the game, which makes for loyalty. But of course the ideas of the executive, because presumably they ought to be more valuable, must also be thrown into the "pot," and this is of very definite value in both education and encouragement to all down the line.

The Matter of Education

It must be understood, however, that even in the most effective organizations there is no monopoly, even with the ideas of all considered, of all the best possible methods. Constantly, new and effective schemes, technically, from the engineering or the industrial engineering point of view, arise in other units in the same trade and indeed in all other trades. As a matter of fact most of the schemes and methods that operate in any one unit are the result and the experience of other units. Means must be developed to discover and bring these to the front for consideration. This necessitates a plan of education.

There are many sources of education. Makers of machinery, trade associations, engineering associations, technical societies, technical books, trade and technical magazines and papers, and educational courses, local or correspondence, all offer varied and considerable possibilities, and the industrial executive has in these all the needed opportunity.

In the paper trade there is a technical association which has pooled its knowledge in a set of books, and one company has a class of fifty studying these books. This company also subscribes to a dozen or so magazines covering not only the paper trade but also industrial engineering and selling literature, and routes them monthly to the departments which should be interested, with the request that they be carefully read and all applicable ideas be brought, with adaptive suggestions, to the attention of the executives.

This concern also has a number of its employees as members of technical organizations, and encourages them to attend conventions. It encourages the members of its executive organization to take any worthwhile courses, local and correspondence, paying the expense thereof. Its salesmen take public speaking and advertising courses.

It is evident that such a course of action offers an opportunity and inspiration to properly selected men to keep up-to-date methods under consideration and to put the adaptable ones into practice.

Keeping the Organization Up to the Mark

An executive organization, being composed of human beings, needs certain methods of discipline as well as training and education. The best discipline for a wideawake man, of course, is to show him the facts.

One concern makes a point of providing the members of its organization with comparisons of the current situation and previous good ones. Men need goals to aim for. This company also keeps an error book in which are recorded and reported monthly to all departments, all complaints, errors, and losses through bad work, with detailed investigation and placement of blame and period analysis. Nothing is so disciplinary as a definite discussion with a department of its lapses, and of methods of avoiding them. Very much better than the discussion of occasional lapses, however, is the discussion of a comparison of recorded lapses over a period with actual statement of losses.

Of course the most effective method of discipline lies in the salary list. It is wise and valuable for the industrial executive to have a regular period, preferably the beginning of the year, when he goes over the list of salaries of all of the members of his organization, decides definitely as to their merits in this respect, and discusses their value, their good points and their weaknesses in relation to the unit with them. This gives a great opportunity to inspire, to strengthen the courage and energy, and to put fight into the organization. To let such an opportunity pass, leaves a doubt in, and puts a damper on, the minds of his organization. The results are apt to be discouraging.

Of course the methods of training, education, and discipline will vary with different trades, and with different sizes of units. Each concern will want to develop its own methods but the principles are the same, and the necessity is imperative in every concern.

There are, for instance, cases where the selling plan involves large numbers of men who are widely scattered. Probably the most effective method of training and educating salesmen lies in the selling school, with annual gatherings at the manufacturing center. There are many well known concerns which carry out this plan, as, for example, the National Cash Register Company. One concern in Pennsylvania varies this plan by insisting that its novice salesmen take a two months course through all the operations of the unit. After this, each salesman on his return to the center has full interviews with all important executives with an exchange of views on the outside and inside problems of the unit.

What every executive organization needs in addition to training, education, and discipline, is inspiration. Men need, to do their best, to feel that the thing they are doing is fine, even if it is necessary and routine. They need ideals and a vision of accomplishment. Men think of themselves preferably as playing some big part, as heroic, as important, as romantic. This is merely the human nature of it.

Now there is in industry all of these things if industry be understood. There need be nothing prosy in business affairs, if they are operated with the service idea. It is only when the purely selfish is uppermost, when the doing of a thing for pure gain is undertaken, when the interest of others or the value to others is unconsidered, that business becomes prosy. It detracts nothing from its profitability to see industry in the larger way, as a service to be spread, to be sensitive to public wants, to be a happy co-operative effort. It adds definitely to results that each one should see his part as an important one, the most competent doing of which makes the whole more complete and effective.

There are indeed many executives who are in a real sense heroic for their accomplishments in the eyes of their subordinates, and particularly so because of their fairness, their willingness to teach what they know, their open minds to all suggestions, and their frankness in giving the authors due credit. If these are good qualities they may be just as heroic in their practice all down through the executive organization.

Men want to do big things, but after all big things are merely comparative and are big only because they are larger in accomplishment than something previously considered fine. So in industry it is a big thing to increase a service, to reduce a cost, to simplify a system, to present a new and result-producing view, to make a laid-down plan most effective, to create a new thing, to improve a quality, to make co-operation more effective, even to do routine work well and promptly, because there are so many men in industry who are doing none of these things.

Every man in an executive organization has or ought to have hopes and ambitions. It is the part of the industrial executive to supply the inspiration for these things in his executive organization, because thereby he can definitely increase his results.

There are a number of practical ways in which this can be done. If men are to be given ideals to work for they must be told something of the plans of the unit, and particularly some of the facts of progress as working toward those plans, so they may bend their efforts towards the general goal. When a man feels he is part of the game, knows the plan and the progress, he has a basis on which to fight, and fighting co-operatively makes loyalty.

An industrial unit has a soul and spirit as well as a body. That unit is successful whose industrial executive rouses its spirit, creates for it a soul by inspiring his executive organization to understand that each member may be doing fine things in carrying on his work and finding ways to improve it. When that is accomplished a serviceable unit has been built.

Nothing offers, to the industrial executive himself, the inspiration and foundation for the proper discharge of his duties as the understanding of industry as a broad co-operative service. And nothing offers such sure and permanent profit as the intelligent building of an organization to support this ideal.

Correct Costs at Little Expense

A System for the Small and Medium-Size Plant

By GAYLORD G. THOMPSON

Manufacturing Analyst, Cutler-Hammer Manufacturing Company

Index Number
658.14 Financial control
657.452 Cost accounting

THE work of cost keeping is looked upon by many manufacturers as too involved and too expensive for a small or medium-size plant. The elaborate systems adopted by large concerns, are undoubtedly open to these criticisms when applied to an organization employing only a few hundred workers. But when stripped of extreme refinements and condensed to give approximately correct results at little expense, a cost system proves of invaluable aid in running even a small plant. The present article explains a system for use in a factory where the management is concentrated in a few major executives and where it is imperative to keep clerical work at a minimum in the interest of profits. For purposes of clearness of illustration the methods are outlined as applied to a plant manufacturing plumbing goods. But the utility of the system extends to practically all branches of industry.

A knowledge of costs is necessary to the successful running of every business. But the needs of the small and medium-size manufacturing plant for a system giving approximately correct costs at a low expense have never been adequately met. A simple method, however, exists for collecting and compiling cost data to get reliable results. Mr. Thompson explains this method in a way that makes it immediately useful to every manufacturer who is confronted with cost problems in his plant.

A large factor contributing to the difficulties of a cost-keeping system in plumbing and brass goods industries is the lack of standardization in manufactured products, especially where it affects combinations of fixtures or units. The element of standardization as it would apply strictly to every detail in plumbing installations is practically impossible. Building constructions will continue to reflect a certain amount of individuality of designs; consequently the plumbing industries have no other alternative than to meet these conditions as a characteristic demand of the trade.

The installation of a cost system in a plant manufacturing a large variety of plumbing goods is a proposition in which the eccentric nature, style, and combinations involved, present problems of cost accounting so difficult of solutions consistent with simplicity, that a large number of manufacturers or dealers in this class of goods depend mostly upon estimating, or the "by guess and by gosh" method of cost keeping.

Then, again, there are some concerns that base their selling prices on comparisons with competitor's prices and trust to luck that inventory time will reveal the hoped-for profits. It is a fact that two competitive concerns were known to be watching each other's price list and setting their own respective prices accordingly. Each one thought the other had a good cost system. It is amusing to view this practice from one angle, but a serious proposition to those who must stand for the inevitable financial crash when such methods are carried on without curtailment.

Competition in the manufacturing and distribution of general brass goods and plumbing supplies is more acute than in most of the other phases of industrial activity. This condition is largely superinduced by the price slashing practices of numerous small concerns that do not know their accurate costs.

One plumbing goods manufacturer was known to have placed a large quantity of goods in a virgin territory at a figure that was impossible to conceive as profitable. The competitor, who was already established in this territory, undoubtedly knew his costs, and after forcing the market to a new low level, he withdrew from this territory goods that did not show a profit. This step left the new competitor with the undesirable part of the field to himself and with a mess of unprofitable orders on his hands. After he finds that his profits are missing he will have a hard job trying to convince the trade that a higher price must be established.

The concern which knows its costs and ordinarily will not go below them to meet competition is the one which can meet the sharpest possible competition intelligently and without loss. It is true that some orders will be lost, but in the long run it is best to let them go to the concern which, in many cases of unusually low prices, does not know its true costs, and thereby runs the danger of "cutting its own throat". If the orders are large they will probably put this competitor out of business, in which event the concern knowing its costs will again control the market without sustaining any losses, and at the same time will have gained greater prestige and the confidence of the trade because of stability.

Although the cost system described in this article is intended primarily for manufacturers, it nevertheless contains features of cost keeping that will apply to jobbers and dealers in plumbing goods. The fundamental principles of the entire system remain the same for all. In presenting this system, consideration has been given to the fact that manufacturers of plumbing goods are, in the majority of cases, small concerns when it comes to questions of floor space and number of people employed. The volume of business and the scope of marketing territory are, however, the proper gages of size. In this article, references to the small concern apply to firms which find that intricate and refined methods of cost keeping and recording are not absolutely essential. The methods described are adapted for use where no fine line is drawn to separate the functions of numerous executives and department heads.

The chart shown in Fig. 1 is a fair example of how the functions of plant management have been condensed to require the time of only three major executives, while the cost system described in this article is operated by two or three clerks in the office. This chart represents the organization of a plumbing goods manufacturer doing a business amounting to $400,000 to $700,000 per year and capable of greater capacities with the same office force.

A system of cost keeping in a small concern must have features of flexibility that will readily adapt it to expansion as the concern grows. At all times it must more than pay for its cost and not overgrow the concern so that it becomes a burden unproportionate to profits.

The accuracy of a compilation of cost records depends upon the accumulation of facts from which cost information is obtained. It is a simple matter to allocate the various charges and credits when proper costs are known. The method used to *originate* these cost figures is in most instances the cause of failure in the installation of a cost system. Too much red tape or a conglomeration of forms for collecting minute details of cost facts, with its consequent increase in clerical work and possibility of multiplied errors, is often worse than an approximate cost system.

A cost derived without the use of forms containing minute details, but practically reliable in its conclusion, is the one of most value to the executive in guiding the destinies of his business. The predominant demand of most executives is for conclusive cost facts and not for the means of determining these conclusions. The method of arriving at cost conclusions is reviewed as a matter of supervision by the executive for his own satisfaction and at a time when his other duties are not demanding his immediate attention.

The problem is, therefore, to eliminate all functions involved in the originating of costs that do not contribute to facts upon which to base immediate conclusions. Data or records which are compiled after conclusions or decisions have been made, are often worthless, even though they may be interesting from a historical standpoint.

Simplicity in the method of originating cost data is of more pronounced possibility in a small concern, for which this article is intended, than in a large concern. Consequently a broad viewpoint must be assumed where seeming impossibilities appear, or where the explanations are of an elementary nature.

The classifying of accounts is practically, although not necessarily, the first step in the installation of a cost system. The fundamental principles of such a classification constitute an element of standardization characteristic of all forms of accounting practice. Complexity or simplicity in classifying accounts is largely the result of judgment or opinion of those in charge of this function. However, this judgment or opinion may be influenced or superinduced by external circumstances encountered in different types of manufacturing concerns. In any event, simplicity consistent with accuracy is the desired goal.

The following classification of accounts is given here to convey a better understanding of the discussion in the paragraphs to follow. It will be noted that the account numbers tend toward numerical sequence. The missing numbers between some of the account numbers are left open for any possible addition of new accounts.

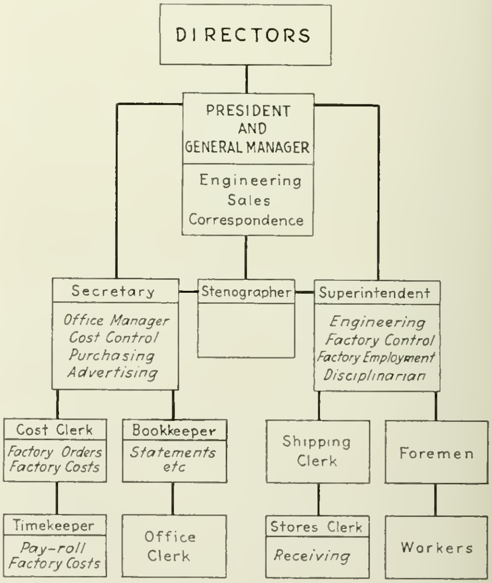

Fig. 1 Organization Chart for Medium-Size Concern

Current Assets

Acct. No.	
1	State Bank
2	Petty Cash Fund
3	Notes Receivable
4	Accounts Receivable
7	Personal Accounts
10	Stores
11	Supplies
12	Work-in-Process
14	Tool-Making Material and Labor
15	Pattern-Making Material and Labor
17	Premium on Life Insurance

FIXED ASSETS

Acct. No.	
19	Land
20	Buildings
22	Building Improvements
23	Machinery and Equipment
24	Flasks
25	Permanent Tools
26	Perishable Tools
27	Patterns and Drawings
28	Delivery Equipment
29	Patents
30	Office Furniture and Fixtures
31	Factory Furniture and Fixtures
36	Prepaid Insurance
37	Prepaid Subscriptions
38	Prepaid Advertising

CURRENT LIABILITIES

41	Notes Payable—Bank
42	Notes Payable—Trade
43	Accounts Payable—Trade
44	Accounts Payable—Personal
48	Accrued Pay-roll
49	Accrued Commissions
50	Accrued Taxes
54	Allowance for Depreciation—Buildings
55	Allowance for Depreciation—Building Improvements
56	Allowance for Depreciation—Building Machinery and Equipment
57	Allowance for Depreciation—Flasks
58	Allowance for Depreciation—Permanent Tools
59	Allowance for Depreciation—Patterns and Drawings
60	Allowance for Depreciation—Delivery Equipment
61	Allowance for Depreciation—Patents
62	Allowance for Depreciation—Office Furniture and Fixtures
63	Allowance for Depreciation—Factory Furniture and Fixtures
71	Land Contract
77	Surplus
78	Profit and Loss
79	Dividend
88	Current Profit and Loss
90	Sales
95	Cost of Goods Sold
100	Selling Expense
200	General and Administrative Expense
400	Rent Received
401	Discount Earned
402	Miscellaneous Sales
403	Interest Received
409	Contra Net Income
420	Discount Allowed
421	Interest Paid
422	Interest on Land Contract
423	Donations
429	Contra Other Expense

WORK IN PROCESS

Acct. No.	
12-1	Material Used—Factory
12-2	Foundry—Direct Labor
12-3	Indirect Labor
12-4	Gas
12-5	Supplies
12-6	Repairs
12-7	Depreciation
12-8	Foundry—Insurance
12-9	Taxes
12-10	Light and Power
12-11	Material Used
12-14	Cost of Castings
12-15	Machine Shop—Direct Labor
12-16	Indirect Labor
12-17	Supplies
12-18	Repairs
12-19	Depreciation
12-20	Insurance
12-21	Taxes
12-22	Light and Power
12-23	Tool Supplies
12-24	Tool Repairs
12-25	Pattern Supplies
12-26	Pattern Repairs
12-27	Experimental Work
12-28	Outside Labor
12-36	Polishing and Plating—Direct Labor—Polishing
12-37	Indirect Labor—Polishing
12-38	Supplies—Polishing
12-39	Repairs—Polishing
12-40	Depreciation
12-41	Insurance
12-42	Taxes
12-43	Light and Power
12-44	Indirect Labor—Plating
12-45	Supplies—Plating
12-46	Repairs—Plating
12-55	Assembling—Direct Labor
12-56	Indirect Labor
12-57	Supplies
12-58	Repairs
12-59	Depreciation
12-60	Insurance
12-61	Taxes
12-67	Store—Packing—Shipping—Labor
12-68	Supplies
12-69	Repairs
12-70	Depreciation
12-71	Insurance
12-72	Taxes
12-73	Light and Power
12-74	Delivery Equipment Maintenance
12-81	General Factory—Labor
12-82	Supplies
12-83	Repairs—Buildings
12-84	Water and Gas
12-85	Heating
12-96	General Ledger Control Account

SELLING EXPENSE

Acct. No.	
100-1	Commission
100-2	Bonus
100-3	Traveling Expense
100-4	Salesmen's Samples
100-5	Freight, Express and Cartage "Out"
100-6	Salaries
100-7	Advertising
100-8	Photos and Catalogs
100-9	Postage
100-10	Supplies and Stationery
100-11	Telephone and Telegrams
100-12	Subscriptions and Dues
100-25	Contra Selling Expense

General and Administrative Expense

Acct. No.	
200-1	Officers' Salaries
200-2	Office Salaries
200-4	Supplies and Stationery
200-5	Professional Services
200-6	Telephone and Telegrams
200-7	Postage
200-8	Cleaning
200-9	Subscriptions and Dues
200-10	General Traveling Expense
200-11	Insurance
200-12	Taxes
200-13	Repairs
200-14	Water, Light and Gas
200-15	Heating
200-16	Depreciation
200-40	Contra General and Administrative Expense

It will be noted that account Number 14 is assigned to "Tool-Making Material and Labor" and Number 15 to "Pattern-Making Material and Labor". These accounts are partly stores accounts, but owing to the small quantity of materials involved it was found most expedient to make charges for materials direct to these accounts and have the materials delivered direct to the toolmaker or pattern-maker, respectively, instead of through the storeroom. These accounts are credited for the amount of materials and labor used in the making of a tool or pattern and charged into the fixed asset accounts according to the nature of the asset. The method of obtaining costs of patterns or tools will be explained in the section entitled "Issuing of Factory Orders," to follow in another instalment.

Overhead or Burden

The distribution of overhead or burden in a manufacturing concern involves more complexities than those experienced by jobbers or dealers. A flat overhead rate is more easily applicable to a jobber's business than to that of a manufacturer. Departmental overhead rates are, for manufacturers, by far the most accurate means of getting true costs. If a flat rate of overhead is used in manufacturing, regardless of departments, the costs on some articles will be more or less than what they should be, with the consequent danger of receiving large orders for articles on which a loss is actually sustained and very few orders for those on which a profit could presumably be realized.

An example of this condition is found where an article requires very little machine work in proportion to bench work. Bench work does not incur the high expense that machine work does. Consequently if bench work is forced to carry the same overhead as the machine work, the apparent cost of articles requiring mostly bench work will be excessive and will reflect itself in lost sales. The reverse of this condition is of greater danger because of unseen losses that might creep in through orders on which the application of a flat rate of overhead is insufficient. The law of averages does not apply to percentages of a flat overhead rate for all manufacturing departments combined. To force this conclusion is often the cause of red ink entries in the "sad news" column of the ledger.

The apportioning of overhead or burden can be handled in several ways; first, by application to direct labor cost; second, by application to direct labor time; and third, by the machine hour rate. The first method is the most convenient and simple and is fairly accurate where wages are uniform. However, if wages are not uniform, the second method is the better of the two. For example, a worker earning 50 cents an hr., who completes a job in one hour will show a direct labor cost of 50 cents for the job. Assuming that the overhead is 60 per cent of direct labor cost, the overhead charges will be 30 cents. Now then, if this same job is finished in the same time by a worker whose rate is 30 cents an hr., the overhead rate would be only 18 cents instead of 30 cents in spite of the fact that the same amount of time, floor space, power, etc., were used. If the overhead rate were based on labor time instead of labor cost, the overhead charges would have been the same, which is the correct result.

Where a shop has a piece-work system installed, the inconsistencies of overhead figures as applied to direct labor cost are largely overcome because of the existence of standard labor costs for the various operations involved in manufacturing. The overhead referred to in the further discussion of the system described by this article is based on percentage of direct labor cost. For plumbing goods manufacturers this method has proved satisfactory, particularly with piece work.

Nickel Plating Operations Carried in Overhead

Many plumbing goods manufacturers have their own nickel plating departments. Consequently a discussion of nickel plating costs is appropriate at this point. Where quantities of goods that are fairly uniform can proceed through the operations of nickel plating without continual interruption, the method of obtaining costs can be carried out on the same basis as costs in the machine shop, or on the weight basis.

As a rule, however, the nature of plumbing products is not so standardized but what a considerable amount of special nickel plating operations must be performed. A piece of this and a part of that must often be plated to complete special combinations made to order. To maintain accurate costs under these conditions is practically impossible as the cost would be prohibitive.

A method used to overcome this trouble is to treat the entire nickel plating department as an overhead item and distribute it in proportion to direct labor cost on *nickel buffing*. The nickel buffing operation is chosen to assume the overhead distribution of nickel plating because nickel buffing time bears a very consistent relation to nickel plating time. Although this method of determining nickel plating costs is not assumed to be the best, nevertheless results have proved satisfactory, without any expense of additional records. Its simplicity is a prominent feature in its favor, and more than offsets many arguments against it.

The next section of this article, to appear in an early number, will deal with stores, purchasing, and the handling of detail costs in a small-size industry.

Balance Sheet Analysis

ALEXANDER WALL

Secretary-Treasurer, Robert Morris Associates

WHAT is the purpose of balance sheet analysis? The purpose is to read the figures of a series of balance sheets so as to bring out more clearly, or emphasize, trends or strains in financing not easily recognizable in the dollar figures.

Stephen Gilman in his article,[1] "A Method of Balance Sheet Analysis" states, in a very clear and concise manner the reasons for the necessity of a closer analysis than the mere comparison of the dollar figures. He says:

> The need for balance sheet analysis is based upon the known fact that the financial position of every business is constantly changing either for better or worse. Distortion of financial position means that the various classes of balance sheet items do not bear their proper relationship to each other. It is for indication of such distortion that the balance sheet reader searches. From this viewpoint, therefore, *the problem is not one of studying the actual amounts shown on the balance sheet, but rather one of relationships between the classes of items composing the statement.*[2]

An appreciation of this fact, so clearly stated by Mr. Gilman, led the writer to experimentation in an attempt to discover the other important proportions, or relationships, between items composing a statement, beyond the current ratio which by general usage had become a recognized test for credit strength at least 20 years ago. This search has evolved 7 additional sets of relationships, the meaning of which must be fairly obvious to any credit analyst, because they are only the numerical expression of the tests used by every credit man in the analysis of any statement. Too often, however, they have been but unrecorded mental reactions. The reduction to a recordable figure is a step—though a small one—in advance.

Index Number
627.372 Balance sheet analysis
658.14 Financial control

TABLE 1. RELATIONSHIPS EXPRESSED IN FRACTION FORM AND THEN AS A RATIO

Relationship of current assets to current liabilities = $\frac{\text{current assets}}{\text{current liabilities}}$ = Current Ratio.

Relationship of merchandise to receivables = $\frac{\text{merchandise}}{\text{receivables}}$ = Merchandise to Receivables Ratio.

Relationship of net worth to fixed assets = $\frac{\text{net worth}}{\text{fixed assets}}$ = Net Worth to Fixed Assets Ratio.

Relationship of net worth to debt = $\frac{\text{net worth}}{\text{debt}}$ = Net Worth to Debt Ratio.

Relationship of sales to receivables = $\frac{\text{sales}}{\text{receivables}}$ = Sales to Receivables Ratio.

Relationship of sales to merchandise = $\frac{\text{sales}}{\text{merchandise}}$ = Sales to Merchandise Ratio.

Relationship of Sales to Fixed Assets = $\frac{\text{sales}}{\text{fixed assets}}$ = Sales to Fixed Assets Ratio.

Relationship of sales to net worth = $\frac{\text{sales}}{\text{net worth}}$ = Sales to Net Worth Ratio.

These relationships have been spoken of and written about by the writer as ratios, following the nomenclature adopted by common practice of calling the relationship between the current assets and current liabilities the "Current Ratio". General practice expresses this particular relationship as 2 to 1 or 1.5 to 1, etc., as the case may be. The writer has deviated from this form by expressing the 2 to 1 relationship as a single percentage number, 200 per cent, and the 1.5 to 1, as 150 per cent. These express in percentage form the relationship borne by the numerator of the fraction to the denominator, and simply transform the fraction to a percentage or decimal figure. The principal advantage in this lies in the greater ease and accuracy in recording and comparing successive relationships.

Statement of Standard Ratios

In the following list the relationships referred to are expressed first in fraction form and then as a ratio. This division and reduction to a decimal is the actual practice in developing the ratios used and advocated by the writer as statement tests. (Table 1).

It will be noted that the first 4 of these ratios are developed from balance sheet items and reduce the relationships between two important items in each event to an easily recordable figure, so that changes in relationships on any series of statements may be readily noted, compared, and deductions made therefrom. The second 4 of these ratios are relationships between the net annual sales and certain related balance sheet items. They express the relative rapidity of operation in merchandising, of collection in receivables, of plant activity in fixed assets, and of capital activity in net worth.

Application of Ratios

The figures of the Ames Manufacturing Company submitted by Mr. Gilman in his Table 1 are here given in Table 2.[3] From these figures we develop the ratios as shown in Table 3.

As the supposed length of time necessary to compute these ratios has at times been raised as an objection the writer timed the computation of the ratios above noted. The actual time was one min. and 32 sec. for each year. It seems perfectly reasonable to assume, therefore, that not more than 10 min. at the very outside would be needed for the making of a four-year table after the process of condensation had been accomplished. In addition to this, such computation can be made by the average machine clerk, and is not necessarily the work of other than a moderate-price subordinate credit department operative.

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[1] See MANAGEMENT AND ADMINISTRATION, August 1924, p. 147.

[2] The italics are the writer's.

[3] See MANAGEMENT AND ADMINISTRATION, August 1924, p. 149.

As a substitute for these ratios Mr. Gilman offers Table 4. Referring to the ratios[4] and Table 4, he makes the following statement:

TABLE 2. COMPARISON OF BALANCE SHEETS
as of January 1, Ames Manufacturing Company

	1921	1922	1923	1924
Assets				
Cash	$ 4,652	$13,371	$ 7,190	$10,512
Accounts Receivable (net)	14,468	8,217	5,629	5,857
Total Quick Assets	$19,120	$21,588	$12,819	$16,369
Inventories	17,556	20,607	28,077	22,210
Total Quick Assets and Inventories	$36,676	$42,195	$40,896	$38,579
Fixed Assets (less Depreciation)	17,922	25,707	36,163	37,290
Prepaid Expenses	76	213	2,545	2,459
Total Assets	$54,674	$68,115	$79,604	$78,328
Liabilities				
Notes Payable—Trade	$ 1,000	....	$ 3,000	$ 1,000
Notes Payable—Bank	4,000	$ 4,000	3,000	2,000
Accounts Payable	7,000	4,000	8,000	5,000
Dividends Payable	2,000	....	2,000	2,000
Accrued Liabilities	128	690	337	248
Current (and Total) Liabilities	$14,128	$ 8,690	$16,337	$10,248
Capital Stock Outstanding	$50,000	$50,000	$50,000	$50,000
Surplus or Deficit	9,454	9,425	13,267	18,080
Total Net Worth	$40,546	$59,425	$63,267	$68,080
Total Liabilities and Net Worth	$54,674	$68,115	$79,604	$78,328
Sales	$52,088	$66,383	$90,652	$96,691

> They both tell the same story, but the index method (referring to Mr. Gilman's percentage table) tells it at a glance, while the table of ratios requires considerable study before the good and bad trends are manifest. Clearly, the company shows a tendency toward overinvestment in fixed assets, which have increased to 208 per cent in 1924 as compared with an increase in sales to 185.6 per cent and an increase in net worth to 167.9 per cent.

As a matter of fact the table presented by Mr. Gilman is in no way a table indicating the "relationships between the classes of items composing the statement," which is the test in analysis offered by Mr. Gilman in the early part of his article. It is a table noting the variation of the amounts from the first statement of the series. It is a growth or shrinkage table for each separate item. To use it the comparative growth or shrinkage of any two items may be noted. But to get a relationship for any one year, such relationship would have to be computed for the first year, and that multiplied by the differential of increase or decrease of the component parts of the relationship. For example, if the analyst wished to know the actual relation of the net worth to the debts in 1924, he would first have to compute it for 1921, the base year. This would be the fraction $\frac{40.546}{14.128}$ equal to the percentage decimal of 286 per cent. To get the relationship between these two items as of 1924 this would have to be multiplied by $\frac{167.9}{72.5}$ which equals 662 per cent. To compare the relationship between these two items with the relationship for the same two items as between 1923 and 1924 would involve a very considerable amount of adjusting computation in that each year would have to be compared first to the base, and the results compared to each other.

TABLE 3. RATIO TABLE FOR AMES MANUFACTURING COMPANY

	1921	1922	1923	1924
Current Ratio	259	485	250	376
Merchandise—Receivables	121	250	498	379
Worth—Fixed	225	229	163	171
Worth—Debt	286	683	387	664
Sales—Receivables	360	807	1,610	1,650
Sales—Merchandise	296	322	322	435
Sales—Fixed	289	256	231	243
Sales—Worth	128	111	143	142

TABLE 4. COMPARISON OF BALANCE SHEETS
as of January 1, Ames Manufacturing Company
Based on percentage of 1921 figures (Index Method)

	1921 ACTUAL	1921 PERCENTAGE OF 1921	1922 PERCENTAGE OF 1921	1923 PERCENTAGE OF 1921	1924 PERCENTAGE OF 1921
Assets					
Quick Assets	$19,120	100	112.9	67.0	85.6
Inventories	17,556	100	117.3	159.9	126.5
Quick Assets and Inventories	36,676	100	115.1	111.5	105.2
Fixed Assets	17,922	100	144.4	201.7	208.0
Prepaid Expense (omitted) Total Assets	$54,674	100	124.5	145.5	143.2
Liabilities					
Current Liabilities (also total)	$14,128	100	61.5	115.6	72.5
Net Worth	40,546	100	146.6	156.0	167.9
Total Liabilities and Net Worth	$54,674	100	124.5	145.5	143.2
Sales	$52,088	100	127.4	174.0	185.6

What the Ratio Represents

The ratio table (Table 3), as used by the writer, is a record of the yearly relationships of items for each separate year and the variations do not measure the increase or decrease in the size of the items, but changes in the statement proportions. With the exception of the Merchandise to Receivables Ratio, which must be read in the light of the general position in the business cycle, an increase in any ratio is itself a sign of improvement, and a decrease a sign of weakness. The position of increasing proportional investment in fixed assets is clearly shown by the fall in the Worth to Fixed Ratio from 225 to 171 per cent, and the decrease in the sales productivity of the fixed assets is as clearly shown, and at a glance, by the fall in the Sales to Fixed Assets Ratio from 289 to 243 per cent. When the analyst once familiarizes himself with the fact that proportions rather than size are the important things to consider, and realizes that the ratio method gives him a history of these proportions, he can at once sense the changes for better or worse in the proportions of his risk by the increase or decrease in the ratio in an evident and clearly defined manner. This is in reality what Mr. Gilman does when he compares the increase in Net Worth to 167.9 per cent and the increase in Fixed Assets to 208 per cent except that he does so by comparison to a base year in which he does not actually establish the relationship. Therefore, at no time does his index table actually measure relationships, as proposed, which Mr. Gilman starts out by saying is the real test.

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[4] See MANAGEMENT AND ADMINISTRATION for August 1924. Table 2, p. 149.

Requirements of a Complete Index

One objection to the use of this ratio method of analysis has been the belief that the interpretation of 8 ratios, in the place of relying solely on the Current Ratio, adds a complexity to the analysis that makes it impractical. It is so much simpler to compare the fluctuation and position of the one figure, the Current Ratio, and rely on its movement as an indicator than to study the movements of 8 ratios, that the complacent mind prefers to follow the easier although perhaps less secure road. Practice has placed its approval upon the Current Ratio method supplemented by mental reservations and the tendency of the average mind is to follow custom, come what may. But the additional 7 ratios are only an exact and numerical method of computing and recording the mental reservations above noted. Experiments are being made in an attempt to co-ordinate the several trends in relationships indicated by the separate ratios so that as a result the analyst may have one index figure to compare from year to year. The so-called "Index" proposed by Mr. Gilman is not in fact an index, but is a series of indices, each separated item being indexed in its relation to a base. To get the whole story these indices must be interpreted in their relative increase or decrease, one with another. This may be a step in that direction, but in itself is not a true, complete index.

TABLE 5. RATIO RELATIONSHIP TABLE

1921 as a Base. Ames Manufacturing Company

	1921[1]	1922	1923	1924
Current Ratio	100	147	96	132
Merchandise—Receivables	100	152	176	168
Worth—Fixed	100	102	72	76
Worth—Debt	100	159	127	157
Sales—Receivables	100	156	178	179
Sales—Merchandise	100	109	109	132
Sales—Fixed	100	88	81	84
Sales—Worth	100	86	111	110

[1] The ratios for 1921, being the base, are at par or 100%.

TABLE 6. YEARLY INDEX

1921 as a Base. Ames Manufacturing Company

	WEIGHTS	1921 RATIO VALUE	1922 RATIO VALUE	1923 RATIO VALUE	1924 RATIO VALUE
Current Ratio	25	25	36.75	24.00	33.00
Worth—Fixed	15	15	15.30	10.80	11.40
Worth—Debt	20	20	31.80	25.40	31.40
Sales—Receivables	10	10	15.60	17.80	17.90
Sales—Merchandise	10	10	10.90	10.90	13.20
Sales—Fixed	15	15	13.20	12.15	12.60
Sales—Worth	5	5	4.30	5.55	5.50
Total	100	100[1]	127.85	106.60	125.00

[1] Equals parity or 100 because used as base.

Developing an Index

As a first step in creating an index figure came the realization that the several ratios do not have the same analytical value. In some special cases the value of one or more ratios approximates zero. For instance, in analyzing the statement of a purely trading company having almost no fixed assets, the ratios of which the fixed assets are a part are almost valueless. The question of co-relating these ratios has been experimentally solved by assigning to them varying weights on the basis of having the total weights equal 100 in each instance.

The next step in the index development is to establish the relation, for each ratio used for these statements under analysis, to the same ratio for such statement as may be adopted as a base, from which to measure deviation. As an example of this, turn to the Ratio table for Ames Manufacturing Company (Table 3), and note the current ratio for 1921 as 259 per cent, and for 1922 as 485 per cent. The proportion or relation between these two, using 1921 as a base, is expressed by the fraction $\frac{485}{259}$. Reduced to its decimal percentage equivalent, this would be 187 per cent. This means that the current ratio for 1922 is 87 per cent stronger than the current ratio for 1921. If the value in analysis for the current ratio, i. e., its weight, be set at 25, then the current ratio for 1921, that being the base, would be parity or 25 in value, but the current ratio in 1922 would be 187 per cent of 25 or 46.75.

Limiting Ratio Fluctuations

In experimental practice, however, it has seemed advisable to limit the possible fluctuations of this proportion so that at no time could it exceed twice its base value. As the strength of any ratio increases above its base, its importance in arithmetic variation diminishes. A change in a current ratio from 200 to 250 per cent is much more significant than a change from 400 to 450. If a current ratio which has been 450 per cent should fall to 400 per cent, it is not as alarming a symptom as if a current ratio of 250 per cent fell to 200 per cent, and yet the actual fall is 50 points in each case. The selection of a point twice its base value was adopted because then it would be theoretically possible for a ratio, as one or the other of its elements approached infinity, to fluctuate either up or down 100 points from parity. The plus or minus change of the relationship is, therefore, effectually controlled by this method within equal limits above or below 100.

This change in the proportion of a ratio to the base selected has been controlled by the adoption of the following formula, whenever the individual ratio exceeds the base ratio.

$$\text{Proportion} = 100 + \left(100 - \frac{\text{Base Ratio}}{\text{Individual Ratio}}\right)$$

This would mean that as a maximum the proportion could theoretically equal 200 per cent if the individual ratio were to reach infinity.

Applying this formula to the Current Ratios for the Ames Manufacturing Company for 1921 and 1922 with 1921 as a base (Table 3), we would get:

$$\text{Proportion} = 100 + \left(100 - \frac{259}{485}\right) = 147 \text{ per cent,}$$

which is the ratio relationship.

The Adjusted Limitation in Operation

This description of a method of adjusted limitation may seem complex in the reading. In operation, however, the simplicity may be better understood by the amount of time necessary to effect the computations. Table 5, representing the relationships of the several ratios each year to the ratios for 1921 as a base, was computed at the rate of one min. and 45 sec. for each year. As in the preparation of the actual ratios, the process is purely mechanical and can be performed without special difficulty by a moderately-priced subordinate operative.

Table 5 shows at a glance which relationships on the last three statements are either stronger or weaker than the same relationships in 1921. It requires no mental effort on the part of the analyst, and such a table should be computed in less than six minutes by a subordinate machine clerk, of no more than fair, average ability.

Computing the Complete Index Figure

We are now in a position to complete an index figure after adopting a weight scale for the ratios. In making the index table, Table 6, the weights used are presented in the first column. These weights have been multiplied by the percentages in the Ratio Relationship Table, Table 5, and the result entered in the "Value" column.

The preparation of the index for 1922 took, in actual time, 55 sec., so that it should be easily possible for a machine operative to prepare this table in 5 min. The time element in arriving at this index figure can be analyzed as follows:

Preparation of four-year ratio table	10 min.
Preparation of ratio relation table	6 min.
Preparation of index table	5 min.
Total	21 min.

The four-year ratio table referred to in the foregoing analysis is found in Table 3.

As this is for a period of 4 years the average time element amounts to something less than 6 min. per statement and that makes a liberal allowance in each case over the actual time consumed in the preparation of these very tables here presented. The best feature in their preparation is the exactness with which the relationships are recorded from year to year, and the fact that this development and recording can be performed by secondary operatives, relieving the analyst from much calculation and many mental reservations and leaving him in a better position to use the discriminating judgment, which is so greatly needed, in the final estimation of goodness. The matter of the time required for the preparation of balance sheet comparisons of this nature is one of no small moment. In individual instances it may be negligible, but when such comparisons are carried through, month after month and year after year, or when they must be made by the credit man and his assistants for a continuing succession of balance sheets, the time element becomes a matter of very real importance.

Selecting a Base

In the preparation of the index figure just discussed the statement of the Ames Manufacturing Company for 1921 was used as a base because it was so selected by Mr. Gilman. In regular practice the writer prefers to use the average statement of several years as a base. This is because such a base has in it the variations of several years, more or less offsetting each other, and as a consequence we are not so apt to be measuring a series of years against a base that, because of one year's peculiarities, is in itself so dislocated as to set the index in a wrong relation to parity. Two indices built up from different bases would run parallel on a chart, but in a different relation to parity. Therefore, the more nearly the base can approximate an average position, the more nearly will the index line, itself, approximate the base—that is, the line representing 100 per cent.

Value of Group Studies

In speaking of group studies Mr. Gilman calls attention to the inadequacy of the groups used by J. H. Bliss in his book "Financial and Operating Ratios in Management" in that in some of his groups there were only three or so company figures. "His largest group of companies, whose figures were available for determining the ratio of sales to inventory, was 12. This would seem to be an entirely inadequate number of instances to serve as a basis for a standard ratio."

Such studies may be inadequate to develop the conclusive figures, but they are indicative and important nevertheless. Our conscious or subconscious attitude toward any statement in analysis is influenced very strongly by our familiarity with that industry. If our accurate knowledge of an industry is limited to the experience with one name and some one can give us a composite picture of two names, he has doubled our knowledge and has supplied the beginning of a background.

The writer has been able during the present year to develop studies in 19 different industries based on a minimum of 17 names and a maximum of 108 names per industry. While even these studies are not conclusive they are in many instances highly indicative, and a comparison of an individual name with its group, either by direct ratio or index comparison, supplements very greatly the inspirational or subconscious belief of what the individual should show.

Comparison of Flat and Round Strapping

By W. H. SACKET

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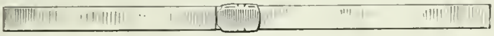
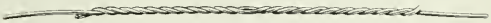
TESTS at the Forest Products Laboratory, Madison, Wisconsin, show that hard-drawn wire (round strapping) and flat metal strapping give practically the same results when used as a reinforcement on wooden boxes, with results slightly in favor of the latter; and that both are considerably better than annealed wire. All comparisons presuppose straps of equal cross-sectional area and held with an efficient seal.

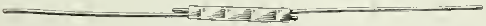
For purposes of test, straps of the different types were bound around western yellow pine boxes measuring 37¾ x 17 x 12¾ in., inside dimensions, which were loaded with 108 wooden cylinders containing sufficient shot to give a net weight of either 100 or 200 lb. as the tests required. The boxes were then tumbled in the laboratory's large, revolving, hexagonal drum-testing machine until the contents were spilled.



1. Flat Metal Strap



2. Round Annealed Wire



3. Round Hard Drawn Wire

Fig. 1 Methods of Fastening Different Kinds of Strapping

The cylinders used to load the boxes were the same in height as in diameter and were packed in such a manner that the axis of every third cylinder was vertical. The axes of the two intermediate ones were horizontal and at right angles to each other. This arrangement, which held for all three directions in the box, practically eliminated "bridging" and allowed individual action of the cylinders, and so brought a more uniform strain on all straps.

For the purpose of comparing the relative effectiveness of flat and round straps, tests were made on three types of strapping: Cold-rolled flat steel, which had a tensile strength of approximately 84,000 lb. per sq. in.; hard drawn wire, with a tensile strength of 90,000 to 100,000 lb. per sq. in.; and annealed wire, with a tensile strength of 50,000 to 60,000 lb. per sq. in.

To obtain the maximum efficiency of strapping, it must be drawn as tight as possible, but without excessive cutting at the edges of the box or breaking of the strap through a combination of tension and the ordinary stresses of handling. All the tests here reported were made with strapping tightly drawn.

Index Number
658.78844 Containers

However, strapping applied to a box so as to fit tight and close at the edges as well as on the sides, top, and bottom, even though it may not be in tension, will strengthen the box considerably. It will continue to be of value as a reinforcement until it becomes so loose that it no longer absorbs any portion of the stresses developed in the box during shipment. Looseness may arise from shrinkage of the box, stretching of the straps, or other causes. In general, the greater the amount of tension under which the strap was applied the longer it will remain tight during storage or shipment.

When two straps are used to reinforce a box they should be placed approximately 1/6 the overall dimension of the box from each end. When one is used it should go around the box midway between the ends.

There are a number of different methods of fastening flat and round strapping. Those used for the strapping here referred to are shown in Fig. 1. The flat and the hard-drawn round straps (numberd 1 and 3) were fastened by crimping their ends in metal seals. The annealed wire strap (numbered 2) was fastened by twisting its ends together with at least three complete turns.

Under the tension of application, round straps will cut considerably deeper into edges than flat straps and will therefore not come off so easily in case of shrinkage of the box. This, of course, is a slight advantage of the round over the flat strap. Another advantage of the round strap is that it is thicker for a given cross-sectional area, and will therefore not catch under nail heads so easily when the box slides over or past other nailed constructions.

The first-mentioned of these two minor advantages is, however, also a disadvantage of considerable importance. The fact that the round strap cuts into the edges of the box more easily than the flat strap causes it to lose its tension and become loose sooner and under less severe handling.

When the round strapping is of soft annealed material its inferiority to the hard-drawn wire becomes apparent through its stretching qualities, which added to its cutting qualities, cause it to loosen more easily.

The foregoing facts were proved by the tests conducted. It was shown that annealed wire is somewhat less efficient as box reinforcement than either hard-drawn wire or flat strapping, and also that the flat strap is slightly more efficient than the hard-drawn wire. The following extracts from test data indicate how the resistance of the boxes to rough handling increased according to the strapping used.

All boxes had standard ends and were of the same inside dimensions for both 100 and 200 lb. loading.

100-lb. Loading.—Boxes with sides, top, and bottom of thickness shown at heads of columns. Number of drops required to burst box and spill contents:

	1/4-in.	*5/16-in.*	*3/8-in.*
Without strapping	3	5	8
Two annealed wires	19	39	58
Two hard-drawn wires	21	54	60
Two flat metal straps	18	63	67

200-lb. Loading.—Thickness of sides, top, and bottom shown at heads of columns. Number of drops required to burst box and spill contents:

	5/16-in.	*3/8-in.*	*1/2-in.*
Without strapping	2	6	10
Two annealed wires	8	17	24
Two hard-drawn wires	18	30	41
Two flat metal straps	21	29	47

The data tabulated above indicate only the number of drops to produce ultimate failure of the box and spilling of contents; but the full test records include the number of drops at "initial failure" (2½ in. width of board loosened) and also at the time when recoopering would probably have been necessary in commercial service.

The relative ability of the various classes of boxes to resist rough handling was determined by averaging for each lot the number of drops required to delevop the three critical conditions mentioned. This average is termed the "resistance" value of the box.

The added "serviceability" of any given strapped box is figured as 60 per cent of the difference between the "resistance" values of the strapped and the same kind of unstrapped box. The reason why 100 per cent of the difference is not used is that at ultimate failure of the strapped box the contents will have been damaged more than when failure occurs in an unstrapped box—in other words, observation shows that beyond 60 per cent of the difference the strapped box does not offer adequate protection to the contents.

To the "serviceability" of the strapping, as thus obtained, is then added the "resistance" of the unstrapped box to obtain the joint serviceability of the combination. These are the data from which the serviceability curves in Fig. 2 are plotted. For each loading the "resistance" curve of the unstrapped box is shown. "Resistance" and "serviceability" have the same meaning for this one curve; it is used as a basis of measurement and comparison, in the following manner (refer to Fig. 2).

To determine the approximate thickness of material to use in a strapped box and still retain a serviceability equal to that of an unstrapped box of thicker material, draw a horizontal line to the left from the point on the resistance curve, which represents the thickness of material used in the unstrapped box, until this horizontal line intersects the serviceability curve representing the method of strapping to be used.

An example will show how the serviceability curve and the resistance curve are to be used jointly. Suppose it is desired to substitute a box with one annealed wire for an unstrapped box with ⅜ in. sides, top, and bottom, loaded with 100 lb. The question is, what thickness of material can be used in the strapped box and still get the same serviceability as the ⅜ in. unstrapped box gives? Draw a horizontal line from the point on the resistance curve which represents the unstrapped box with ⅜ in. sides, top, and bottom loaded with 100 lb. until it intersects the serviceability curve for boxes with one annealed wire. This point of intersection will represent the thickness of material to be used (read directly below) in the strapped box—a little less than 5/16 in. Since in general, the thickness as thus indicated will be some unavailable fraction, the next higher available thickness of material should be used.

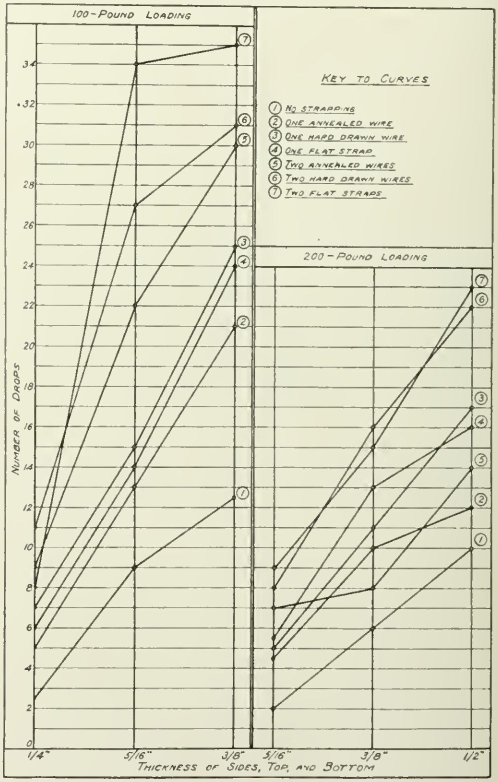


FIG. 2 SERVICEABILITY CURVES FOR STRAPPED BOXES

The tests indicate that the essential difference between flat and round strapping is more a matter of stretching of the wire than of its cutting into the edges of the box. This inference was established by careful measurements of the round strapping before application, between application and test, and after test. Considerable change was found in the diameter of the annealed wire, whereas no measurable difference appeared in the hard-drawn wire. Some slight difference in the diameter of the annealed wire was due to stretching in application; but by far the greater difference was caused by its stretching during the test.

How Inventories Were Reduced at the Dill and Collins Company

By DURWARD EARLE BURCHELL

Consulting Industrial Engineer

Index Number
658.787 Inventories

DILL AND COLLINS COMPANY manufacture a complete line of book and coated papers in a very large variety of qualities, weights, sizes, and finishes. Although large quantities are special papers made on customers' orders the company also manufactures large quantities for stock. Adequate supplies of different qualities, weights, sizes, and finishes are carried in warehouses in Philadelphia, Boston, New York, Chicago, and other cities. Also, a complete stock and variety must be carried at a central storehouse and shipping point.

The company has developed its business through years of gradual growth in the Delaware mill located in North Philadelphia. At this mill is manufactured soda pulp and a full line of papers. The equipment is complete for operating 5 paper machines and making a complete line of machine dried, coated, and brushed finished papers. Several years ago the company purchased another mill equipped with 4 paper machines. The product of the new mill was the same as the Delaware mill and therefore did not increase the company's variety of papers, but simply increased the output.

Although the storage space of the Delaware mill was large, there were times when it was inadequate, requiring excessive handling of finished stock, and at times it was necessary to use public warehouses.

In considering the purchase of the Flat Rock mill at Manayunk the president of the company foresaw that since there would be no increase in the varieties of paper manufactured the stock carried at the combined warehouses need not be much larger than the quantity formerly stored at the Delaware mill. This gave him every reason to expect that while there would be a large increase in output there need be no marked increase in quantities of finished paper carried in stock at the combined mills. However, as time went on it was found that the quantity of stock carried at each of the mills was as large as before the combination. The president emphasized this in conference with the sales manager at the time and urged that the quantities of finished stock be reduced. The sales manager contended that it would be impracticable to reduce the stock and at the same time give satisfactory service to the branch warehouses and to customers. After much discussion the president ordered that some form of detailed analysis be prepared to show the exact situation, feeling sure that his original contention was correct.

The first step was to prepare a comparative monthly statement which would show the quantities on hand, sold, and made each month for each kind, quality, weight, size, and finish of paper. Most of the data were prepared for other purposes and it was only necessary to exhibit the essential information so that it might be examined and studied from month to month.

It was found that there were excessive quantities of inactive and deteriorating paper on hand. There was paper which was active in some weights, sizes, or finishes, but not in others. The principal difficulties therefore were with the extremely large quantities of inactive or semi-active stock and a lack of discrimination in stocking active grades. Stocks were frequently low or depleted although there was a steady demand which forced delays and required rushing orders to serve customers. This interfered with regular plans and forced runs at greater expense of manufacture.

When furnished with comparative monthly statements the president was able to point out all these variations from the best practice with the result that the quantity of finished stock was rapidly reduced until it was no greater than that originally carried at the Delaware mill, and, at the same time, quantities of active stock were increased and adjusted according to the demand, with better service to the branch warehouses and to customers. Beside better service, the savings to the company were not only the interest on the investment in excess inventory but also marked savings in cost of rehandling of stock and any rent of extra storage space.

B. F. Goodrich Company Method of Water Cooling

Index Number
621.643 Recirculation of water

IN the rubber industry the problem of sufficient water supply is a major factor in efficient plant operation. It is necessary to have an ample and inexpensive supply of water for vulcanizer cooling purposes. In the plant where

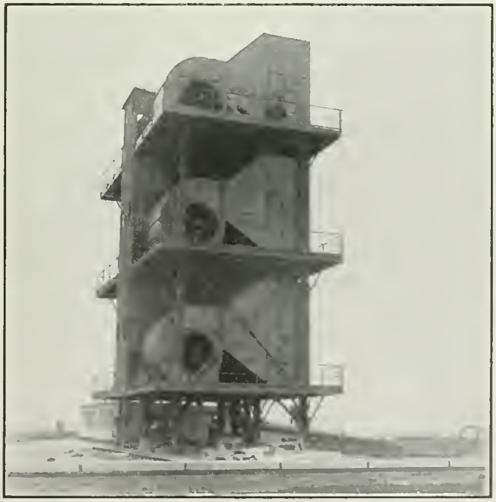


FIG. I WATER COOLING TOWER ON ROOF OF B. F. GOODRICH COMPANY'S PLANT

water is available in large quantities either from a well on the premises, from the city water mains, or from an adjoining lake or river, no difficulty exists. It is simply a matter of building a large reservoir or tank and the water is then pumped from the reservoir to the vulcanizers as needed.

This method, of course, is only applicable where the water supply is abundant and the rates cheap. In the large rubber plant using thousands of gallons of water daily, and paying high city rates, utilization of this method is obviously impossible. The amount of water consumed in a plant operating 40 to 50 vulcanizers throughout the working period, each one functioning 50 to 60 times a day at 8 or 10 min. intervals, is tremendous. The average-size vulcanizer, surrounded by a water jacket, will utilize perhaps 150 gallons for each cooling. This water is used for reducing the temperature of the molds after the tires have been vulcanized.

In this connection, more than ordinary interest attaches to the manner in which the B. F. Goodrich Company, of Akron, Ohio, solved their difficulties. This plant was accustomed to drawing its supply from a small creek in the neighborhood. After use, the water was discharged back into the stream, but due to the large quantity of water handled, the creek was kept continually polluted with warm water.

The Goodrich officials finally determined to abandon this method and install in its place a system of water recirculation. The apparatus is shown in Fig. 1. It consists of six air-washers of the Carrier type and six fans, manufactured by the Buffalo Forge Company. The whole is built in the form of a tower some 60 ft. high. The fans are full-housed and with top horizontal discharge, but three are made right-handed and three left-handed. The washers will handle 167,000 cu. ft. of air per min. at 690 ft. per min. velocity. The hot water from the vulcanizers comes to the spray nozzles at 20 lb. pressure and at a temperature that may range anywhere from 160 deg. fahr. to 90 deg. fahr. The nozzles in the washers are arranged to spray in an opposite direction to the flow of the air, while baffling plates are placed at the inlets of the washers.

The vulcanizers themselves are placed on the first floor of the plant, or in that portion commonly known as the pit. The pumps receive the hot water after it has passed through the vulcanizers and discharge it directly into the towers. After being sprayed through the washers, the newly cooled water goes to a big storage tank of 210,000 gallons capacity from which it is carried by gravity to the molds.

Some of the advantages which this particular method has over the system formerly used are as follows: It is somewhat quicker in cooling, which permits more rapid operation and increases the capacity of each vulcanizer unit. It has eliminated the pond or reservoir formerly maintained. The fact that this cooling tower arrangement can be erected on the roof of a building makes its space requirements of no concern to the factory management. With the towers installed on the roof, advantage can be taken of the gravity flow on the return, thereby necessitating but one pumping operation. With the water reservoir on the surface level, pumping of the water is necessitated both on the intake and return. With this new type there is absolutely no loss whatever from windage or drift of the spray. The Carrier spray coolers are equipped with water eliminators which effectively remove all entrained water from the air.

Speeding Up Production in the Restaurant

Index Number
658.3835 Employee restaurants

THE main restaurant of the Schenectady Works of the General Electric Company serves about 3000 meals a day. Half of these are served at noon, and since a large proportion of the 1500 are served to factory workers who have only 30 minutes for lunch, considerable speed is necessary in order to give all a chance to eat during the allotted time. Mechanical conveying is used to provide a method by which from 120 to 160 meals can be served per minute.

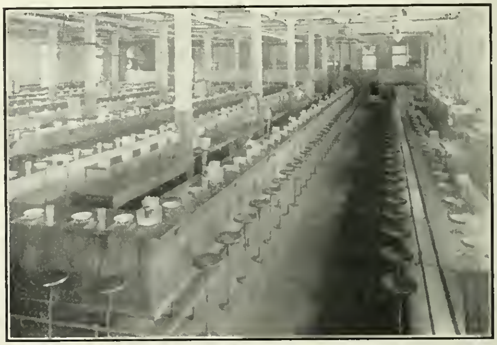


FIG. 1 FIRST FLOOR OF RESTAURANT

The restaurant is arranged as in Fig. 1, the second floor arrangement being identical with the first. At

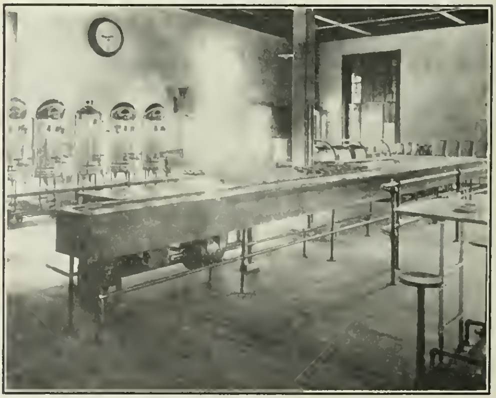


FIG. 2. SERVING COUNTER

noon two lines form for service on the lower floor and two on the upper. Each line passes by a cashier who sells meal tickets for 25 cents each. Incidentally, it is interesting to note as an example of manual dexterity, that these cashiers operate a cash register and make change for from 30 to 40 ticket sales a minute. The line passes down the aisle to the end, where tickets are exchanged for aluminum trays. On the way the men have seen the menu for the day and have chosen their dishes. They place their trays on a belt-conveyor which takes them past the hot plates and tables from which food is chosen. (See Fig. 2.) At the end of the conveyor each tray is checked for quantity, and its owner carries it to a table. Both the lower and the upper floors are used simultaneously.

The belt-conveyor is the heart of the system. Its use makes possible serving speed otherwise unobtainable. Its speed is adjustable, but 65 ft. a min. has been found to be most satisfactory. This allows each person 15 seconds to select his food, and from 30 to 40 can be served a minute.

An interesting sidelight is the fact that, whether or not influenced by serving speed, the rapidity with which meals are eaten makes it possible to serve some 1500 meals with a total seating capacity in the restaurant of 1100, and many fewer dishes than would be thought possible. As soon as a meal is finished the dishes are gathered up, washed, dried, and returned to the serving tables. So rapidly is this done that at 12:10 o'clock, dishes and trays are being used for carrying their second load of food.

Keeping Track of Factory Drawings

By RICHARD NEUBECKER

Index Number
658.561 Shop methods

IN manufacturing establishments where drawings and specifications must follow the stock through the various processes, it is not always an easy matter to keep track of the drawings, after the work has once started coming through the plant. When the drawings are not readily available by the department requiring them, work is often delayed until the drawings are located.

In plants where work is in process on several floors, the location of the desired drawing is not always such an easy matter as it would seem, and it often occurs that drawings become badly mutilated or lost, in which case there generally is no one about the plant that ever remembers of having had, or seen, that particular drawing.

To obviate conditions of this kind in their plant, a certain large establishment in the east which had had considerable trouble in this regard adopted the following method.

A large blackboard was located in the designers and billers' room, on which an indexing chart was made that not only located the desired drawing instantly, but also showed at a glance exactly how far each order had progressed in the plant. (See Fig. 1.) The drawings were numbered and sent to the design and billing department. As drawings were removed, a cross was placed in the proper location where drawing could be found. Thus, for instance, we find drawing No. 1 in the shaping department while drawing No. 2 is in the designer's room, drawing No. 3 can be found in the planing department and No. 5 in the molding shop. No. 13 has not yet left the office.

In the plant in which this plan was in use, the designer's room was located in the center of the plant, the drawings being kept in their proper pigeonholes near the indexing board. No employee was permitted to take any drawing to another department of the plant without first indicating on the blackboard its exact future location.

LOCATION	NUMBER OF DRAWING																
Office	1	2	3	4	5	6	7	8	9	10	11	12	13	14	33	34	35
Designer	x	x	x	x	x	x	x	x	x	x	x	x		x			
Biller								x									
Planing			x														
Cutting																	
Gluing										x							
Trimming									x								
Molding					x												
Shaper	x																
Sanding																	
Cabinet																	
Glazing																	
Shipping																	

FIG. 1 INDEXING BOARD FOR LOCATING FACTORY DRAWINGS

This indexing board has saved many otherwise unproductive hours of employees chasing each other around the plant trying to locate a drawing that apparently had become lost. If strict attention is given at the time this plan is instituted no trouble will be found in getting the men to indicate properly location of the drawings.

Uniform Cost Conference

REPRESENTATIVES of more than 300 trade associations have been invited to attend a conference on uniform cost accounting to be held at Congress Hotel, Chicago, October 28 and 29. The meeting will be the third of a series held under the auspices of the Department of Manufacture of the Chamber of Commerce of the United States for the purpose of furthering interest in systematic cost accounting work.

The preliminary program for the Chicago conference lists two subjects for consideration on the opening day. One of these is "The Bankers' Interest in Uniform Cost Accounting," to be discussed by J. W. O'Leary, Vice-President of the Chicago Trust Company, and the other "The Printer, Uniform Cost Accounting, and the Federal Trade Commission". The latter subject will be discussed by two speakers who will go into the question of the Federal Trade Commission's attitude toward uniform cost accounting activities.

THE EDITORS' PAGE

Management Week

"GOOD management!" said the pork-packer to his friend of the Pullman, "why in my business we save everything excepting the squeal". "Yes?" said the other, a lumberman from the Pacific Coast. "Well in my business we save everything including the bark".

Perhaps that was good management. It was, so far as the statement goes. Also it would conform to the requirements of the days not yet entirely gone, when the one recognized duty of management was to produce in terms of money. Dividends were the Napoleonic test, and that manager was most successful who paid the largest dividends. How he got the money to pay these dividends was too often a matter of indifference. That was up to the manager.

Contrast this with the principles of business recently formulated by the United Chamber of Commerce. As said in the prefatory statement:

> The function of business is to provide for the material needs of mankind, and to increase the wealth of the world and the value and happiness of life. In order to perform its function it must offer a sufficient opportunity for gain to compensate individuals who assume its risks, but the motives which lead individuals to engage in business are not to be confused with the functions of business itself. When business enterprise is successfully carried on, with constant and efficient endeavor to reduce the costs of production and distribution, to improve the quality of its products, and to give fair treatment to customers, capital, management, and labor, it renders public service of the highest value.

Here we have in terse, forceful language the whole duty of management—for to management belongs the responsibility of realizing these ideals in practice. If the manager takes the statement quoted for his creed, and lives up to its requirements, he will be a good manager regardless of whether he makes profits—and it is safe to say that he will make profits too. For these requirements, idealistic as they may sound, are not Utopian. Speaking generally they must be observed for any large and lasting success.

And in realizing this, business has progressed far. *Caveat emptor* is still a maxim of the law, but what present-day business manager would venture to adopt it as his policy? On the contrary the most successful business managers make the buyers' interests their own—and make money when they do it.

All this is not altruism—it is merely good business. "To reduce the cost of production and distribution" is the shortest road to profits. "To improve the quality of its products" with but reasonable, if any, increase in price is merely an incident in the "fair treatment" of customers.

Nor can the claims of labor be ignored, nor does "fair treatment" end with the shop. It is again merely "good business" to see that the workers are comfortably housed—that they have good schools and churches, and wages sufficient for comfortable living.

And to capital, management likewise owes a duty. It must make a fair return, "to compensate its risks," but this fair return must be fairly made.

But all this may not be enough. The manager may be rendering "public service" but if it be not "*of the highest value*," he is so far a managerial failure.

It is the tendency of the manager—in common with the rest of mankind—to look upon his handiwork, say it is good, and then rest content. And if his results are good why should he not? Simply because the good manager is never content. As soon as he is content he ceases to be a good manager. There is no standing still in management. As soon as a manager ceases to go forward he falls backward—and out of the ranks of good management.

Herein is found the value of "Management Week" with its inspiration, its practical information, its illuminating discussions, its healthful and enlivening contacts. No manager could have taken part in its proceedings in the right spirit without distinct advancement in his calling. It jolts the routine manager out of his ruts. It is a step on the "gas" for the live manager who is not in the ruts.

Here also is found the value of a magazine such as MANAGEMENT AND ADMINISTRATION whose whole "public service" is the advancement of management—a magazine constantly keeping in view the highest ideals and requirements of management and crowded with suggestion, information, and inspiration—all that makes for the greatest efficiency in management.

And to avail himself of these and all other real helps is one of the manager's first duties. For management is not static, and, as has been said, the manager who does not progress is falling behind. Even now, new forecasting methods are curbing the devastation of the business cycle; budgeting is becoming a mere matter of routine; better methods of direction and control are being developed; and, all along the line, the risks and avoidable losses of business are being reduced to a minimum. And the manager who does not realize this and the paramount necessity of keeping both himself and his organization alive and up to the point of greatest operating efficiency, is either a poor executive or is not properly "on to his job".

Forecasting Precedes Budgeting

BUDGETING was the topic discussed during Management Week, just concluded. It was the subject of the first technical session of the National Association of Cost Accountants' Convention, reported in the October issue. It has been treated in numerous articles appearing in MANAGEMENT AND ADMINISTRATION. It has received the attention of several authors who have written books about it. It has been allotted a section in the first "Management's Handbook," just published. It is of vital interest to industry.

But—an essential requirement for every manufacturing budget is an estimate of future sales. Before any budget can be constructed the future course must be charted. Forecasting must precede budgeting.

To many manufacturers forecasting means simply that from conversations, newspapers, and such sources they learn that business is going to be "good" and take such steps as may seem necessary to them to prepare their organizations for a period of "good business". Budgets will be of little avail to such concerns.

Business forecasting is a science—not so exact as some, possibly, since it is largely empirical or based upon experience and observation—but still certain fundamental principles have been proved and upon these has been built a procedure that is reasonably exact in its results. Heretofore, the statistical methods used were known to professional forecasters and statisticians but to very few laymen. Available published material on the subject was written in a language foreign to the mind of the average manufacturing executive. Seasonal variations, link relatives, multiple frequency tables, medians, were only words to him.

It is necessary, however, that these methods be explained to business executives before they can take full advantage of the economies offered by forecasting and subsequent budgeting. Briefly, the usual method is to determine the relation between the cycle of a particular enterprise and the cycle of general business activity whose future movements can be predicted with reasonable accuracy. This relation is determined by comparing with a general business index data showing trends in the individual business.

But simply to compare such items as actual sales, inventory, or production with a general business index is insufficient. Before a comparison can be made the figures must be corrected for several modifying factors such as seasonal variation, and normal growth. After these corrections are made there is still a bar to direct comparison with a general business index. A general index such as those published by professional agencies portrays general business conditions or the probable trend in an "average industry," and an average industry is as hard to find as the long-sought "average citizen". The trend for any particular industry will, in all probability, vary both in period and extent from the general business trend. The laws governing this variation must be understood before a comparison of the two trends can be made.

A few concerns have based their forecasts on scientific investigation and procedure and have benefited greatly thereby. A notable example is the Walworth Manufacturing Company which started a budgetary system based on scientific forecasting in 1922. For the first year their actual sales were within 0.5 per cent of their estimate, and instead of seasonal variations in production they were able to equalize production throughout the entire year. That such close control was a real achievement is proved by the fact that their products comprise over 23,000 articles.

In his series of articles now appearing in our pages Mr. Barber, of the Walworth Manufacturing Company, gives detailed methods for making business forecasts to fit the needs of the individual. They are based on the experience of his company and written in such a way that the statistical mysteries surrounding forecasting practice are made plain. By using these methods each concern can accurately determine its position in the business cycle and can confidently chart its future course. The information to be presented in this series will enable industrial executives greatly to increase the value of the results from budgetary control.

The Place of Power in Industry

BACK of every advance in the art of manufacturing is a story of power development. Power is the vital life blood circulating through the arteries of industry. Without it civilization could not exist.

Larger phases of the subject of power have been thoroughly studied in such recent undertakings as the World Power Conference, the Coal Storage Report of the American Engineering Council, and the Power Survey of the State of Pennsylvania, by Morris Llewellyn Cooke. A Superpower Survey with the object of zoning the nation for power distribution has also been the subject of serious investigation extending over several years.

But the industrial executive is more directly concerned with the power problem of his own plant. Assisting him in its solution are hundreds of concerns engaged in the manufacture of power plant apparatus. Steam production has been brought to a high state of efficiency by the present-day boiler, stoker, coal handling equipment, and allied apparatus. Steam utilization with the utmost economy is possible through such mediums as the modern engine and turbine, with their condensers and related equipment. Internal combustion engines are likewise cheaply operated producers of power. Electrical energy is generated and transmitted under full control and applied to a multitude of purposes. Regulating, indicating, and recording devices of all sorts keep a check on operations at all stages. There is practically nothing impossible in these fields.

Even though he may buy his power from a public utility, a manufacturer must supply his own means of putting it to work. For this purpose motors, belting, shafting, and a multitude of other appliances have also been developed to answer every sort of industrial need.

Hence there is no longer any excuse for considering the power plant as a necessary evil, and neglecting to give it the same careful attention and efficient apparatus as is supplied to the rest of the plant. Neither is there any further reason for an executive to remain in ignorance of the present highly efficient development of power apparatus. The Third Annual Power Show, to be held in New York during the week of December 1 to 6 will give every manager something to think about. Even the man with the most up-to-date power-producing and power-consuming equipment will find new inspiration to improve his methods, and new opportunities to save money in this vitally important department of his business.

NEWS OF EQUIPMENT
FOR THE MANAGEMENT

This department is conducted to give our readers essential facts regarding items of industrial equipment recently placed on the market, that may be used to increase production or lower costs. Each item is indexed according to the Dewey Decimal System so that it can be accurately filed for future reference. The editors will be glad to furnish additional information about any item. All information given is obtained from reputable manufacturers, and MANAGEMENT AND ADMINISTRATION accepts it as reliable.

Air Brush and Pressure Feed Unit

Index Number 658.28 Labor-saving devices

A NEW air brush particularly designed for rapid covering or coating large surfaces, and ground laying, is the type K F manufactured by Paasche Air Brush Company. A variety of spray heads to furnish different shaped sprays can be obtained, and changes from one type to another can be made quickly. Elimination of complicated needle and valve mechanism increases wearing qualities. Extension tubes in various lengths from 6 in. to 36 in. can be quickly attached, making it possible to reach inaccessible places. Fluid valve is self-oiling and has automatic adjustment. Same design brush is used with all size containers and all parts are interchangeable.

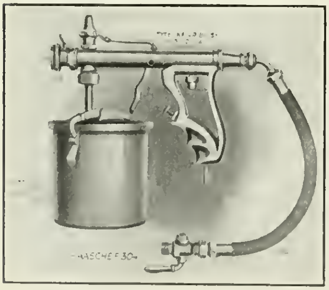


FIG. 1 TYPE K F AIR BRUSH

For the elimination of waste of both time and materials experienced in the continual refilling of gravity containers, and also for increasing the speed of application, the Paasche Air Brush Company is marketing Pressure Feed Units. Their use eliminates loss by evaporation and the necessity of taking down and refilling overhead containers. Uniform application at any desired speed with less air pressure is possible with these containers. They are seamless and drawn from one piece of sheet steel. A "quick change" hand hole cover can be removed easily for cleaning or changing colors. An air control distributing head with an agitator is furnished with each unit. The units are mounted with or without a one-wheel aluminum base. Extra refill containers in a variety of sizes can be inserted in the large container by removing the "quick change" cover. Units are furnished in 3, 6, 9, 12, 25 and 50 gallon sizes.

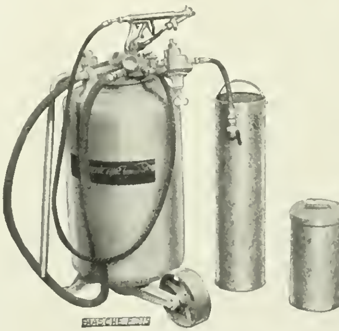


FIG. 2 PRESSURE FEED UNIT

Lineshaft Bearing

Index Number 621.82 Bearings

A NEW lineshaft hanger bearing, embodying Timkin tapered roller bearings, is being manufactured by the Dodge Manufacturing Corporation, for use in all power transmitting services where ruggedness, simplicity, interchangeability and trouble-free lubrication are important.

The bearing contains five parts. Two Timken tapered roller bearings are mounted on a ground and slotted steel tube and fitted to a machined housing. The ends of the tubes are threaded to receive clamping collars used to secure accurate adjustment of the bearings. This method of mounting utilizes the bearings for both radial and thrust loads. The steel tubes can be fitted to any commercial shafting by tightening the screws in the clamping collars. Grease compartments are provided between the housing and the steel tubes. Outer ends of the bearings are protected from dust by metallic grease seals that eliminate friction at this point and prevent dust working in or grease working out.

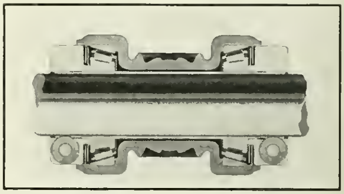


FIG. 1 LINESHAFT HANGER BEARING

To erect the bearing, it is only necessary to slip the bearing over the shaft and set up the clamping screw in each of the split clamping collars.

Speed Transformer

Index Number 621.3143 Transformers

A "SHORT cut" from electric motor to machine or from shaft to shaft where speeds are widely different is provided by the "Industrial Type Spur Gear Speed Transformer," developed recently by The Hill Clutch Machine & Foundry Company. It is designed for such speed changing services as conveyor drives in paper mills, steel plants, cement mills, or any industrial service where speed transformer units are operated under continuous or heavy service conditions. It is a closely coupled unit and requires little space for installation.

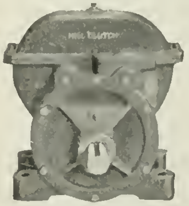


FIG. 1 SPEED TRANSFORMER

The speed transformer consists of a nest of plain spur gears, having 20 deg. involute form cut teeth, which change the revolutions per min. of the input shaft to some desired speed of the output shaft. The central housing is located in the main frame, permitting both high and low shafts to be supported in double bronze bearings, insuring strength, rigidity, and quiet operation. Accessibility is obtained by removable cap and ends. Splash lubrication is used, and the unit is enclosed in a dust- and leak-proof case. Both high- and low-speed shafts are in identical axial alignment, and revolve in the same direction.

Transformers are made in seven sizes. Each size is designated by a number which bears a fixed relation to the diameter of the low-speed shaft and which also indicates the horsepower the low-speed shaft can safely transmit at 100 r.p.m. Size numbers are 10, 20, 35, 55, 85, 120, and 160.

Electric Pipe Threader

Index Number
621.99 Pipe threading

A NEW electric pipe threader that reduces the time and cost of pipe-threading has just been placed upon the market by the Oster Manufacturing Company of Cleveland, Ohio. It is claimed that this motor-driven threader turns out more work in less time and with less effort at half the cost of production than hand methods.

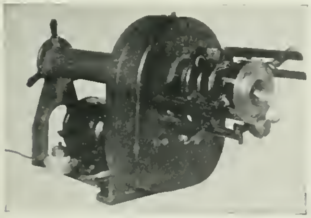


Fig. 1 Electric Pipe Threader

A built-in vise aided by an auxiliary chuck, both of which are self-centering and self-locking, holds the pipe securely in place while the die-stock is being turned by the motor. In addition to threading the pipe this machine does the cutting off and the screwing up of the fitting. The gears are completely encased and are run in oil.

The machine is driven by a 1/3 hp. Westinghouse motor and is furnished with a 10-ft. cord and a screw plug which may be screwed into an ordinary light socket. The machine is portable and may be mounted on a service truck eliminating the necessity of bringing each piece to the workshop to be threaded.

Electric Hoist

Index Number
658.281 Hoists

A NEW electric hoist featuring simplicity of design for maintenance and repair work is manufactured by the Chisholm Moore Manufacturing Company. This C-M hoist is designed on the principle of the fewest possible things to get out of order, and those easily fixed if they do. With the removal of 6 bolts the entire hoisting mechanism can be pulled out of its housing for inspection or repair. It can be furnished with stationary mounting or equipped with trolleys.

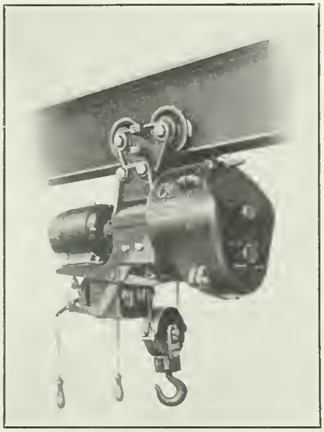


Fig. 1 Electric Hoist for Maintenance and Repair Work

An enclosed motor is connected through a flexible coupling to the hoist, and is equipped with a shoe type brake operated automatically by the controller, which is standard enclosed drum type. Upward travel of the hook is limited by a safety switch. A Weston load brake controls the load at all times. Plow steel hoisting rope is used, attached to cast steel hook with machined sheave and drop-forged hook and ball race. Two reductions of plain spur gearings are used.

Unit Heaters

Index Number
697 Heating

OWNERS of machine shops, woodworking plants and similar industrial places where steam or hot water is available for heating will be interested in a new unit heater developed by the Buffalo Forge Company and designated as the Breezo-Fin. The manufacturer has combined in the new heater light weight, efficient air distribution, noncorrosive construction, rigidity, compactness, high transmission capacity, and ease and economy in installation.

A series of heater tubes, the unit casing, a fan and motor, constitute the component parts. The heater tubes, of copper, are wound with a copper ribbon which increases the radiating surface of the coils and thereby affords rapid transmission of the heat. The fan used is of the Buffalo Breezo type equipped with 10 cup-shaped blades. A totally enclosed silent motor, having waste-packed bearings, furnishes the motive power. These bearings require oiling only once every 3000 hr. of running time. The motor itself is equipped with a thrust plug to prevent end play. The design of the fan blades insures even air distribution over the entire face of the fan.

Two different speed motors can be supplied, as desired. Both are direct connected, but one is moderate speed while the other is slow speed, the latter being furnished only when very quiet operation is essential. Method of attachment of the fan and motor to the heater casing can be seen from the accompanying illustration. The housing is of heavy galvanized steel, die stamped to standard template, flanged and punched to facilitate assembly and installation. Two men can carry the heater.

Capacity of slow speed, 850 r.p.m., motor based on air entering at 0 deg. fahr. is 164,000 B. T. U. per hr. capacity of high speed, 1150 r.p.m. motor is 198,000 B. T. U. per hr.

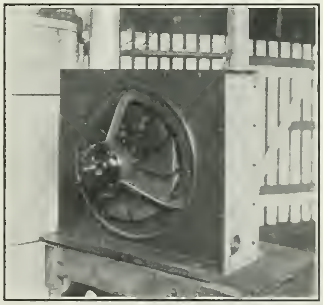


Fig. 1 Unit Heater

Another new product of the Buffalo Forge Company is a direct-fired furnace unit heater of particular value to the small shop, the garage, warehouse, storeroom or similar industrial places where steam is not available. This unit is complete in itself. No connections of any kind are required other than those to the lighting circuit for the motor; no steam or drip connections are needed; no freezing can take place; no skilled engineer need be employed for operation; no foundation other than the floor is required. This heater will burn any kind of fuel—anthracite or bituminous coal, coke, wood, oil, or gas. In ordinary winter weather, when using coal as fuel, it is only necessary to fire two or three times per day.

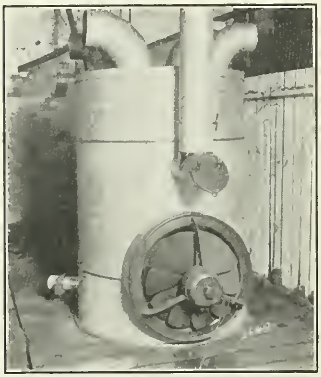


FIG. 2 FURNACE FAN

The furnace itself is of the standard hot-air type, with a galvanized steel casing. The hot air outlets are brought out at the top. A series of baffle plates keep the air in intimate contact with the fire pot and produce a high rate of heat transmission. All parts exposed to the fire are of heavy cast iron construction. The fan supplied with the heater is of the Buffalo Breezo type with 10 cup-shaped blades, driven by a totally enclosed motor equipped with a thrust plug and waste-packed bearings. The fan is very quiet in operation, and is attached direct to the furnace casing. When it is desired to distribute the air to other rooms in the building, a duct system of galvanized pipe may be used.

These unit heaters are made in two sizes. The capacities, principal dimensions, etc., are as follows:

FURNACE No.	B. T. U. PER HR.	A. P. M. AT 70	WHEEL DIA. IN.	FIRE POT IN.	SMOKE COLLAR IN.
322	143,000	1450	18	22	7
326	200,000	2000	24	26	8

Portable Arc Welder

Index Number 621.392 Arc welding

A PORTABLE arc welder which is entirely self-contained and strongly constructed for use in shops where such equipment receives rough usage has been developed by Westinghouse Electric & Mfg. Co. The generator will deliver 300 amp. on intermittent work. Any current from 60 to 300 amp. may be obtained by operating the rheostat handle located on the outside of the control cabinet. Sixty-one rheostat resistance steps enable the operator to obtain close current control.

The generator is designed inherently to stabilize the arc, thereby overcoming instantaneously any resistance fluctuations in the arc circuit, and making relays, solenoids, etc., unnecessary. The operator can readily strike and maintain an arc, obtaining the penetration and fusion necessary for good welding. A standard Westinghouse motor is used, either DC or AC squirrel cage, depending upon the character of the service. All motor operating mechanism except the handle is inside the control cabinet, eliminating danger of operator coming in contact with live parts. All commercial sizes of electrodes from $\frac{1}{16}$ in. to $\frac{1}{4}$ in. may be used. Ball bearings are used throughout with roller-bearing truck wheels.

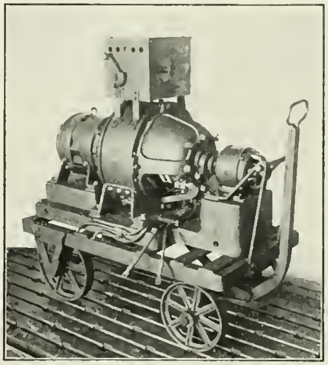


FIG. 1 PORTABLE ARC WELDER

Oil Tank Cleaner

Index Number 600.45 Cleaning devices

WITH the increasing use of fuel oil there has arisen a difficult cleaning problem in the removal of fuel oil sediment from tank cars and storage tanks in industrial plants, ships, and similar places. The method in general use has been: tank was steamed out for 8 hours, then allowed to stand idle for 12 hours. Next it was boiled down with caustic soda, rinsed, swabbed out by hand with gasoline, and steamed again.

International Chemical Company has worked out a general process for this cleaning work which requires no preliminary or after steaming, nor manual labor, and requires less time than the old method. Clear water is run into the tank until it stands several feet above the sediment level. Steam is turned into the tank and the water brought to a boil. International Chemical compounds are added to the contents, all openings, except one small vent, closed, and the tank boiled several hours. The solution is pumped out, leaving the tank clean, since the sediment has been chewed up by the chemical and taken out with the water.

High Pressure Steam Turbine

Index Number 621.165 Steam turbines

THE De-Laval Steam Turbine Company has developed a small steam turbine for service with high pressure and high temperature steam without the use of pressure reducing valves and similar devices. It has been built with materials able to withstand high temperatures and has been designed to keep high temperatures away from bearings and to prevent misalignment due to expansion. Reduction of heat radiating surfaces, simplicity, compactness, and improved speed governing have also been considered.

To prevent misalignment due to expansion caused by high temperatures the casing is intended to be supported on a single pedestal at a point close to its center line. Thus the turbine can expand freely in all directions without affecting alignment of the shaft. Steam inlet nozzle, steam chest, and governor valve are all included in the upper half of the casing to shorten

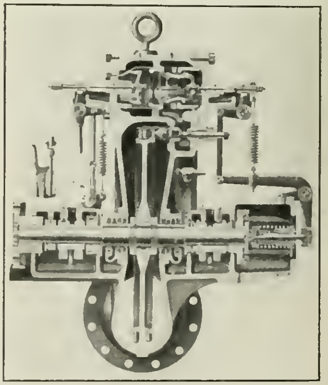


FIG. 1 HIGH PRESSURE STEAM TURBINE

steam passages, reduce radiating surface, and keep high temperatures away from bearings. Water cooling is not required.

In addition to a speed governor there is an emergency overspeed governor which shuts off steam if normal speed is exceeded by 10 or 15 per cent. Turbine is impulse type. The wheel has two rows of buckets and is mounted on a heavy, forged steel shaft.

Feed Water Evaporator

Index Number
621.1871 Feed water evaporator

A NEW, low pressure evaporator designed for the production of pure distilled water for boiler feed make-up has been placed on the market by The Griscom-Russell Company and is called the G-R Bentube Evaporator. It has widely spaced and bowed tubes that distort with temperature changes cracking off accumulated scale. Tubes are fully submerged giving maximum efficiency of heating surface and preventing superheated vapor, hard baked-on scale, and foundation of corrosive gases. Large openings are provided at the bottom of the shell for removal of accumulated scale. Heating surface is sloped for free drainage of condensed steam. Tube bundle consists of a series of independent vertical sections, each removable for inspection.

Shell and vapor dome are welded steel plate with tube leaders of cast iron into which are expanded seamless drawn Admiralty tubes. Steam enters tubes and evaporates raw water in the shell. Working pressure for the shell is 25 lb. per sq. in., and for tubes and steam heads 100 lb. per sq. in. The evaporator is built under A. S. T. M. specifications, and safety valve, steam gage, pressure gage, and water gage glass and fittings are furnished.

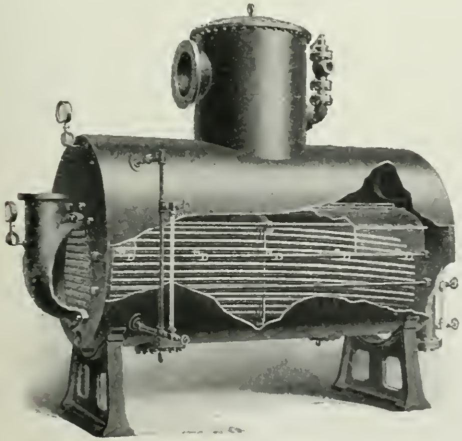


FIG. 1 FEED WATER EVAPORATOR

Starting Compensator

Index Number
621.3143 Automatic transformer

A NEW automatic starting compensator, CR-7051-J1, for squirrel cage induction motors, has been placed on the market. This motor starter is for remote control of constant speed two- or three-phase squirrel cage motors up to 600 volts for general applications driving line-shafting, pumps, compressors, blowers, conveyors, etc. With it such equipments may be started or stopped from a distance by means of one or more small, hand-operated pushbuttons or snap-switches located within convenient reach of the operator, or automatically operated by pressure governor, float switch, thermostat, etc.

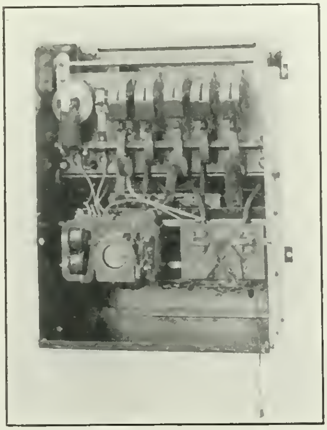


FIG. 1 AUTOMATIC STARTING COMPENSATOR

The General Electric Company, which manufactures this compensator, has incorporated various new features. Definite and adjustable time acceleration is obtained by means of a new induction type relay. Positive overload protection of the complete equipment is obtained by a double pole, inverse time, temperature overload relay. The starting and running magnetic contactors are mounted back to back in a sheet steel enclosing case providing easy access to all parts. Several taps on the auto-transformer provide for adjusting the low voltage for starting to suit the requirements of different installations.

All parts are protected by the steel enclosing case and a conduit box at the back has several knock-outs and furnishes entrance for all power and control wires to the motor starter.

Two-Stage Transformers

Index Number
621.3143 Electric transformers

CURRENT transformers used with electric meters for the purpose of reducing the current to a convenient and safe value for measurement are subject to certain errors which impair the accuracy of the meter readings. These errors are known as ratio and phase-angle errors and they vary in magnitude, at given frequency, with the load being measured, the power-factor of the load, and the secondary burden on the transformer.

The Sangamo Electric Company has recently placed on the market a two-stage current transformer that automatically compensates for ratio and phase-angle errors to any desired degree of accuracy and within wide limits of secondary burden. It is especially well adapted to services where great metering accuracy is required, with heavy secondary burdens; to direct metering of energy supplied to industrial establishments before it enters the power transformers; and to metering all high-voltage transmission lines.

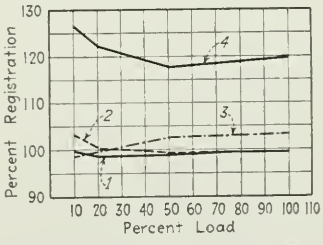


FIG. 1 REGISTRATION OF SANGAMO TYPE H 2 POLYPHASE METER

There are, in effect, two transformers in one. The first yields a secondary current approximately correct in ratio and phase angle. Both primary and secondary currents pass through the windings of the secondary transformer, the ratio of turns of which is equal to the desired ratio of primary current to secondary current. The secondary winding on the second transformer is put on so that the magnetizing effects of the two currents on this core tend to oppose each other. When the secondary current produced by the first transformer deviates from the desired ideal value in magnitude and phase angle, a flux is produced in the second core, which in turn yields a current in an auxiliary secondary winding. This current closely approximates in magnitude and phase angle the current which, added vectorially to the secondary current, will produce an effective current in true ratio and exactly opposite in phase to the primary current.

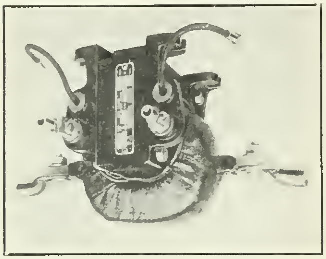


FIG. 2 TWO-STAGE CURRENT TRANSFORMER

Better Letter Bulletins

Index Number
651.75 Letter-writing

A BETTER Letter Bulletin Service is being given by S. R. Stauffer. It consists of a series of cards, each one containing, in condensed form, information concerning proper methods of letter writing. There are 52 bulletins, one being sent each week for a year. A ring is provided by which the cards can be hung near the desk so that they can be referred to easily.

Man Cooling Fan

Index Number
621.63 Mechanical fans

DESIGNED for use in steel mills, foundries, tube mills, drop forge shops, and other places where heat is intensive the Buffalo Forge Company has developed a new man-cooling fan for which is claimed high efficiency of operation. The fan wheel is composed of 10 blades so designed that the air is delivered in a concentrated stream which has considerable carrying power. A direct connected motor placed directly back of the fan wheel supplies the motive power. Two sizes are made, a 36 in. fan which is equipped with a 5 hp. motor, and a 30 in. fan equipped with a 3 hp. motor. Speed of both units is 900 r. p. m. The pedestal is a casting provided with 4 bosses for foundation bolts when the fan is maintained in a permanent location. The fan is constructed of heavy material to prevent vibration and the wheel is protected by a wire screen built upon a foundation of $2\frac{1}{4}$ in. by $2\frac{1}{4}$ in. angle iron.

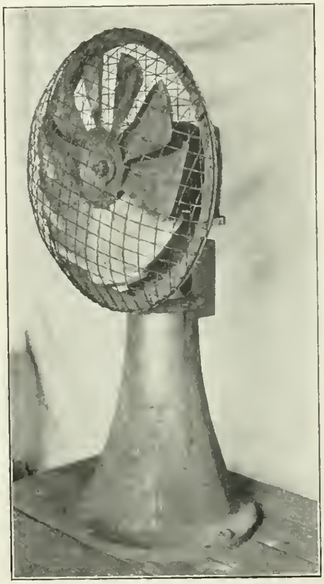
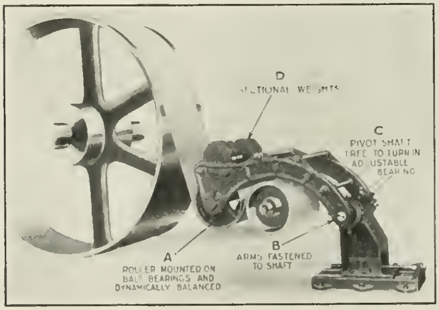


FIG. 1 MAN COOLING FAN

Belt Drive

Index Number
658.2621 Belting

A NEW belt drive, use of which, the manufacturers claim, will eliminate all troubles arising from difference in pulley sizes, position of pulleys, belt slip, which is driver or driven pulley, which is pulling side, and similar factors, is being manufactured by Bird Machine Company and is called the "Pulmax Drive". It is a maximum wrap, short center drive, applicable to nearly all belt drives, that permits maximum pull per inch width of belt to be obtained.


D
SECTIONAL WEIGHTS
C
PIVOT SHAFT FREE TO TURN IN ADJUSTABLE BEARING
B
ARMS FASTENED TO SHAFT
A
ROLLER MOUNTED ON BALL BEARINGS AND DYNAMICALLY BALANCED
FIG. I PULMAX BELT DRIVE

A few of the advantages claimed for it by the manufacturers are: adaptability to all locations and types of drives; automatic operation; shorter belts with longer life obtained; maintenance and installation costs low; increases efficiency; saves floor space and power; permits use of greater pulley ratios.

The drive consists of a ball-bearing roller mounted on an arm which, in turn, is mounted on a shaft supported by a suitable pedestal. The roller is held against the slack side of the belt by a counterweight.

Equipment Catalogs

MONITOR CONTROLLER COMPANY has issued a 4-page bulletin describing edge-wound resistor units being manufactured by them.

In a 48-page illustrated bulletin Spaulding Fibre Company describes its fiber products. The method of manufacturing fiber, suggestions for fabricating, physical properties, and uses are all given.

A 72-page bulletin issued recently by Ingersoll-Rand Company describes and illustrates their compressed air tools and equipment. Many applications for compressed air operated tools are given and, in many instances, comparative cost data.

The Westinghouse Electric and Manufacturing Company has issued a new publication on Micarta Gears and Pinions. Micarta is a self-sustaining, laminated product of woven fabric which can be machined with standard tools and equipment, and may be fabricated into various standard types of gear structure. This publication describes and shows graphically the uses to which micarta gears may be placed, and contains technical data and information on the manufacture, design, and form of construction of micarta gearing.

CURRENT INFORMATION INDEX

FOR THE MANAGEMENT

The material indexed in this department is selected by the editors of MANAGEMENT AND ADMINISTRATION from upwards of 150 magazines; it also includes the publications of some 50 book publishers and professional societies as far as these are of managerial interest to industrial executives. The items are prepared and classified by the Engineering Societies Library in New York City. The decimal number at the right of each item is the index number and indicates the place the article or book will take when filed in accordance therewith in the classified subject scheme. If articles are grouped according to these numbers, like subjects will automatically fall together and related subjects will follow in logical sequence. Photostat copies of any magazine article indexed will be supplied by The Ronald Press Company at a price of 25 cents the page. When ordering photostats please identify the article by quoting from the index: (1) Title of article; (2) Index number; (3) Name, date, volume number, and page number of periodical in which the item appears. A remittance of 25 cents a page should accompany the order. The books and pamphlets indexed can be procured from The Ronald Press Company or from their respective publishers.

Accounting

Administrative and Selling Costs, Their Nature and Distribution. 657.452
W. H. Higgenbotham and Andrew Stewart. *Cost Accountant,* August 1924, v. 4, pp. 83-91 and 91-95. Defines from the accountant's viewpoint administrative costs or expense, and selling or distribution expense and their relation to each other.

Bookkeeping and Introductory Accounting. 657
Henry W. Sweeney. McGraw-Hill Book Co., Inc., New York. 545 pp. $4. Gives, in easily understandable terms and in considerable detail, a clear presentation of the subject matter of bookkeeping and accounting. Designed for textbook use and so contains many problems illustrating the text matter. Should be useful to executives either as a reference book or as a textbook to use for becoming better acquainted with accounting procedure.

Chain Store Accounting. 657.4
Howard C. Greer, C. P. A. McGraw-Hill Book Co., Inc., New York. 312 pp. $2.50. A discussion of the functions and requirements of an accounting system for a chain of retail stores. Although the retail problem is emphasized throughout there are many practices described that should be of considerable interest to manufacturing accountants.

Convention of the National Association of Cost Accountants. 657.452
September 22-25, 1924. H. W. Maynard. MANAGEMENT AND ADMINISTRATION, Oct. 1924, v. 8, pp. 413-416. Review of fifth annual conference, September 1924.

Cost Accounting in the Mechanical Department. 657.452
G. W. Armstrong. *Railway Age,* August 30, 1924, v. 77, pp. 363-367. Illus. Cost knowledge and production control in railroad maintenance.

Cost of Overhead. 657.441
Business leaflets, no. 9, Metropolitan Life Insurance Company, Business Management Service Group Division. 12 pp. Compares problems in different industries, and suggests that overhead should be based on normal production and thus provide for the interruptions intermittently occurring in industry.

Costs for Executives: 3—Where the Burden Comes From. 657.452
N. A. Hall. *Industrial Mangement,* September 1924, v. 68, pp. 135-138. Shows the need for care in making charges for labor and materials, in distributing the elements to the productive centers, and in redistributing non-productive factors, as depreciation, insurance, etc., to productive departments, to obtain accurate cost figures.

Find Actual Cost of Castings. 657.452
G. B. Cocker. *The Foundry,* September 1, 1924, v. 52, pp. 665-666. How to arrive at a fair selling price. Method used by the Cocker Machine and Foundry Co.

Finds Cost by Uniform Method. 657.452
R. E. Belt. *Iron Trade Review,* September 4, 1924, v. 75, pp. 604-606. Advocates the standardization of cost accounting methods within a given industry, as a means of increasing accuracy in determining production costs and in making estimates.

Publicity in Industrial Accounts. 657.79
A. Lowes-Dickinson. *Journal of Accountancy,* October 1924, v. 38, pp. 254-274. Co-operation and confidence between owners, managers, and workers encouraged by the printing of industrial accounts to indicate the costs and profits of company products. Offers a comparison of English and American methods of issuing accounts for the railway, gas and electric, coal, etc., companies.

Advertising

Advertising as a Vocation. 659.1
Frederick J. Allen, A. M. The Macmillan Company, New York. 180 pp. $2. Shows nature, growth, and probable future of advertising, divisions and extent of the field, kinds of mediums employed to reach the public, and various opportunities for employment offered by publicity work. Should be valuable to anyone considering advertising as a vocation and may present some new ideas to seasoned advertising men.

Advertising Response. 659.1
H. M. Donovan. J. B. Lippincott Company, Philadelphia. 195 pp. $2. To be successful, an advertisement must first attract attention and then make an impression on the reader's memory. A study of the advertising factors such as recency, continuity, size of space, frequency, and primacy which influence the success of an advertising campaign is contained in this book. It is based on a questionary, answered by 1000 high school students of Philadelphia, concerning the relative standing, in the students' minds, of various advertised articles. From the answers, various items of information relative to the response to particular advertising methods have been tabulated. This method of measuring advertising response should be of considerable interest to advertisers.

Are You Carrying Coals to Newcastle? 659.1
Sam Freed. *Printers' Ink,* September 25, 1924, v. 128, pp. 102, 104. Advertising campaign for building up the market that is within elbow reach.

The Basics of Advertising Copy. 659.13
Henry Eckhardt. *Advertising and Selling Fortnightly,* August 27, 1924, v. 3, pp. 23, 46. Suggestions for adding to the clearness and conciseness of advertising in order to catch and hold the interest of the public.

Basics of Advertising: 2—The Buried Key-Thought and the Inverted Sentence. 659.13
H. Eckhardt. *Advertising and Selling Fortnightly,* September 10, 1924, v. 3, pp. 21, 43. How force and clearness are gained by placing the main idea first in the sentence.

Budgeting Advertising Expense. 659.1(002)
J. L. Palmer. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 395-396.

Do We Take Our Advertising Too Seriously? 659.13
J. R. Worthington. *Advertising and Selling Fortnightly.* September 10, 1924, v. 3, pp. 17-18, 56. Examples of advertisements which illustrate the appeal of the whimsical, humorous touch.

Does Technical Advertising Need Improvement? 659.13
A. J. Smith. *Business Organization and Management,* September 1924, v. 10, pp. 395-398. Emphasizes the value of

facts rather than generalities, in arousing interest in a product.

What Manufacturers Are Doing With Window Display. 659.133
C. G. Muller. *Printers' Ink*, September 18, 1924, v. 128, pp. 85-86, 88. Analysis of replies from questionnaire sent to several hundred manufacturers.

Building

How to Illuminate Foundries. 658.242
W. H. Rademacher. *Iron Trade Review*, September 18, 1924, v. 75, pp. 741-745. Suggestions for choosing the type and intensity of lamps, and for their installation.

How Would You Pick a Factory Location? 658.21
Morgan G. Farrell. *Factory*, September 1924, v. 33, pp. 336-38, 438. Shows the need for considering local trade districts, traffic facilities, labor conditions, operating expense, etc.

Keeping Track of Your Equipment. 658.27
Walter F. Gunnerson. *Factory*, September 1924, v. 33, pp. 355-56, 450. Methods of recording information regarding original cost, depreciation, and maintenance expense of each unit of plant equipment.

Economics

The Causes of Industrial Unrest. 331.1
John A. Fitch. Harper & Brothers, New York. 424 pp. $3. This book should be read by every employer of labor. It has been written with a definite and limited purpose. This has been "to show that, whether the activities of working people in the defense of, or in the extension of, what they believe to be their rights are wise or unwise, they are not irrational." This purpose has been admirably achieved in a book which is as interesting as it is instructive. Mr. Fitch, a well-known investigator and writer, divides the causes for unrest into three main groups. (1) Economic conditions, including hours of labor, workers' living and income, and unemployment. (2) The old-age struggle between employers and employees during which many unjust methods have been used by both sides. For the particular purpose of the book the injustice of the employing class is treated principally. (3) The government through the activities of police forces and the courts has contributed greatly to workers' discontent because of decisions and actions against the workers' interests. These three factors have been discussed in such a way that few readers will be able to deny that the worker's attitude is rational, whether or not they believe it to be wise.

Forecasting Equipment Demand. 338.97
E. F. Du Brul. *Iron Trade Review*, September 18, 1924, v. 75, pp. 731-734. Stabilization in the machine tool and other equipment industries, increased by a study of the business cycle of those industries and its relation to other indexes.

Government in Business. 350.72
G. A. Hughes. *National Electric Light Association Bulletin*, September 1924, v. 11, pp. 545-551. Arguments against government ownership.

Is Unemployment Inevitable? 331.137
Macmillan and Company, London. 388 pp. 8s. 6d. Unemployment is considered only as a resultant condition of business depression. The book is a comprehensive work discussing business cycles, future outlooks for various British industries, and the statistical side of the employment situation. The first part contains the result of investigations, by the Committee responsible for this book and, "The Third Winter of Unemployment," concerning the causes and effects of the trade cycle, and Great Britain's economic position. Remainder of the book consists of essays by well-known economists and writers. These are divided into three groups: (1) Economic memoranda on the trade cycle and Great Britain's economic prospects; (2) Reports of present conditions in principle British industries with forecasts of future activities; (3) Statistical studies concerning future working population, relation of wages to cost of living, and similar subjects.

The Labor Movement in the Shoe Industry. 331.88
Augusta Emile Galster, Ph.D. The Ronald Press Company, New York. 237 pp. $2. A history of the development and growth of the national labor organizations in the shoe industry. Laborers in this industry were among the first to organize themselves into labor unions so a history of their activities is peculiarly well fitted for a study of industrial labor conditions from the household to the present highly organized factory. This work is based upon conditions in and around Philadelphia which may be considered as typical of the country as a whole.

The New Problems of the Machine Tool Industry in Germany. 338(43)
(Neue Aufgaben der Deutschen Werkzeugmaschinen-Industrie). W. le Vrang. *Werkstattstechnik*, September 1, 1924, v. 18, pp. 449-452. Increased production and lower cost necessary to reestablish the German machine tool industry.

Practice of Rendering Decisions of the Kartelcourt as Applied to Professional Associations in the Mechanical Industries. 331(007)
(Die Spruchpraxis des Kartellgerichts und die Fachzerbände des Maschinenbaues). Tschierschky. *Maschinenbau*, July 24, 1924, v. 3, pp. 751-752.

The Problem of Business Forecasting. 338.97
Edited by Warren M. Persons, William Trufant Foster, and Albert J. Hettinger, Jr. Houghton-Mifflin Company for Pollak Foundation for Economic Research. 317 pp. $4. Papers by about 25 economists and statisticians discussing "the statistical basis for analyzing the current economic situation, with the object of making forecasts of business conditions in general and for the great groups of economic activities in the United States". Precise methods for forecasting are not given but the problems arising from statistics and their interpretation are discussed. To anyone interested in the basic principles of business forecasting this will prove a valuable source for information.

Problems in Business Economics. 338.97
Homer B. Vanderblue, Ph.D., A. W. Shaw Co., Chicago. 631 pp. $5. A valuable book presenting the importance to industrial executives of generally accepted economic principles with particular emphasis on those principles developed in recent studies of the business cycle. The first part of the book presents information concerning the business cycle. This includes its phases, causes and effects, and duration; forecasting business conditions; cyclical variations in manufacturing, mining, employment, advertising, merchandising, bond yields, and money rates; and the control of industry. The next section is devoted to a discussion of over 100 financial, operating, and distribution problems, that have presented themselves for analysis and decision to the managers of various enterprises. The third section contains valuable data on the methods for analyzing time series, various statistical tables, and other information of assistance in measuring the business cycles. Much of the material is based on investigations made by the Harvard Business School where the author is Professor of Business Economics.

Some Troubles and Some Remedies. 33
M. A. Traylor. *Central Manufacturing District Magazine*, October 1924, v. 8, pp. 5-21. Present economic problems of agriculture, labor, taxation, extravagance, and legislation discussed from the viewpoint of a banker.

Things to Tell Your Men. 33
G. E. Roberts. *The Nation's Business*, October 1924, v. 12, pp. 64-66. The four factors that mean modern production are: raw materials, labor, capital, and enterprise. This article discusses the indispensable enterpriser or the business man who makes a real economic contribution.

The Work of an Engineer in the Cabinet. 38
J. H. Van Deventer. *Industrial Management*, September 1924, v. 68, pp. 129-132. Describes the work of the various divisions of the Department of Commerce as built up by Mr. Hoover. Shows how a government department can co-operate with business and industry.

Finance

Administrative and Selling Costs, Their Nature and Distribution. 658.14
W. H. Higgenbotham and Andrew Stewart. *Cost Accountant*, August 1924, v. 4, pp. 83-91 and 91-95. Defines from the accountant's viewpoint administrative costs or expense, and selling and distribution expense and their relation to each other.

Budgetary Control. 658.14
William Carswell. *Paper Trade Journal*, August 14, 1924, v. 79, pp. 51-54, 60. The advantages, preparation, and control of a budget system.

Combating a Billion Dollar Loss. 658.14
Charles Hecht. *Michigan Manufacturer and Financial Record*, September 20, 1924, v. 34, pp. 5, 25. Business failures can be reduced through more careful study of balance sheets. Discusses the use of ratios in balance sheet analysis.

Cost of Overhead. 658.14
Business leaflets, no. 9, Metropolitan Life Insurance Company, Business Management Service Group Division. 12 pp. Compares problems in different industries and suggests that overhead should be based on normal production and thus provide for the interruptions intermittently occurring in industry.

Function of Costing in Industrial Relation. 658.14
J. A. Lacey and H. G. Jenkins. *Cost Accountant*, August 1924, v. 4, pp. 103-106. The significance of costing in industries from the viewpoint of management inter-industry relations.

Industrial Budget Methods. 658.14
J. H. Barber. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 371-376. Charts. Discusses the business cycle and explains comprehensively the methods of scientific forecasting, and shows the results that can be attained.

The Investment of Reserve Funds. 658.14
A. J. Simons. *Business Organization and Management*, September 1924, v. 10, pp. 393-394. Recommends investment of reserve funds in safe securities, and an increase of returns by borrowing from the bank, and reinvesting in securities paying a higher rate of interest.

Management Through Accounts. 658.14
James H. Bliss. The Ronald Press Company, New York. 851 pp. $6. A discussion of accounting distinctly from the managerial point of view. It shows the manager how best to interpret and use accounting reports and statistics in the conduct of business, and it shows the accountant how best to prepare these reports so that they may be of greatest value to the manager. Technical features of accounting have been avoided so far as possible, the chief aim of the work being: To promote a better and more general understanding of industrial accounting practice; to show business managers how to use financial and operating statistics; and to promote a more general appreciation of the benefits to be derived from the use of properly developed accounting reports and statistics. Principal topics discussed are: Financial and operating reports, including consolidated statements, balance sheet and income statement accounts; cost finding for different industries; departmental, plant, branch, and inter-company accounts; account classification and standardization.

Managerial Accounting. 658.14
Vol. 1. J. O. McKinsey. The University of Chicago Press, Chicago. 655 pp. $4. Devoted to the proper managerial use of standards and records, including statistical as well as accounting data. It is based on the assumption that all business administrators should have a basic knowledge of accounting to aid them in their work. Present volume contains first part of material based on course of study presented at University of Chicago. Main subjects discussed are: Need and nature of, and organization for controlling standards and records; administrative reports; sales, purchasing, traffic, and production control. The book is written primarily for students so is free from highly technical accounting or statistical discussions. Each subject is treated fully enough to make the book of real value to all business administratives who wish to learn how their standards and records can be used to greater advantage.

Operating Ratios and Costs as Guides to Management. 658.14
U. F. von Rosen. National Association of Cost Accountants. *Official Publications*, v. 6, September 15, 1924. 7 pp. Methods that will aid to determine the capital required in an enterprise and what should be a fair return on this investment.

Principles of Investment. 332
John Emmett Kirshman, Ph.D. A. W. Shaw Company. 902 pp. $5. A comprehensive, well-organized analysis of the working principles of investing funds. Shows application of sound principles to investment of funds in government and state bonds, municipal, railroad, public utility, industrial, real estate, and foreign securities. The entire discussion revolves around the analysis of risk element and price determination of the various securities. Part 1 discusses the economic basis of investment; Part 2 elements of investment credit; Part 3 application of principles of credit to investment; Part 4 movement of security prices; and Part 5 investment policy.

Taking the Bank to the Factory. 332.2
H. B. Bliss. *Michigan Manufacturer and Financial Record*, September 6, 1924, v. 34, pp. 3, 26. Plan is to take a definite sum from pay envelope and put it to the savings account of employee. Lansing bank created 3000 new accounts in this way.

Visualizing Budgetary Control. 658.14
E. H. Tingley. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 383-386. Planning operations to make a profit. Explains and gives diagram showing factors contributing to the compilation of a budget. Discusses results and benefits that should be obtained from the operation of a business on a budget basis.

When the Manufacturer Wants to Borrow Money for Advertising. 332.1
Roland Cole. *Printers' Ink*, September 11, 1924, v. 128, pp. 3-4, 6. Points to be considered by a banker in extending a loan. Shows that the financial condition and moral standing of the concern seeking the loan are what count, rather than the purpose for which the money is to be used.

Fuel

Advantages in Burning Pulverized Coal. 662.65
F. L. Wolf. *Steam Coal Buyer*, September 1924, v. 2, pp. 22, 24. Why pulverized coal gives more perfect combustion; and figures on comparative costs.

Conserving Our Industrial Fuels. 662.6
G. R. Brandon. *Iron Trade Review*, September 25, 1924, v. 75, pp. 799-801. Heat losses in blast furnaces, furnaces for drop forgings, and other industrial furnaces, and their possible reduction by heat recovery and by improvements in operation efficiency.

The Co-ordination of Fuel Supplies. 662.6
E. W. Smith. *Colliery Guardian*, August 8, 1924, v. 128, p. 355. Suggestions to improve the working results at the collieries and coke ovens, to combine electricity and gas undertakings, and to utilize high volatile and cheaper non-coking coals for gas making, as well as the waste heat available on gas works.

The Drying of Peat for Power Production. 662.6
G. K. Fletcher. *World Power*, September 1924, v. 2 (new series) pp. 156-163. Difficulties encountered in attempting to devise a practicable means of utilizing the latent heat in the steam raised by evaporating the water in peat.

Fuel Economy and Measurement of High Temperature. 662.6
Robert Hadfield. *Foundry Trade Journal*, August 28, 1924, v. 30, pp. 179-181. Deals with the steam boiler, forge furnaces, melting furnaces, regenerators, and recuperators, etc.

How Much Work Can Be Obtained from a Pound of Fuel? 662.621
L. S. Marks. *Power*, September 30, 1924, v. 60, pp. 536-539. Diagr. Methods of determining thermal efficiency.

Industrial Heating With Mercury Vapour. 662.978
H. R. Parker. *The Gas Engineer*, September 1924, v. 40, pp. 198-199. Diagr. Describes essentials of mercury heating installation, the operation of which is comparable with that of a steam heating system.

Low-Temperature Carbonization of Coal. 662.7412
C. M. Garland. *Power*, September 23, 1924, v. 60, pp. 490-493. Diagrs.

Powdered Coal for Small Boiler Plants. 621.182
T. W. Atterbury. *Power Plant Engineering*, September 15, Oct. 1, 1924, v. 28, pp. 937-939, 996-999. Illus., diagrs. The unit method of pulverizing and firing makes powdered coal an economical fuel for plants with few boilers.

Preparation of Fuel in Sweden. 662.6
A. F. Enstrom. *Iron and Coal Trades Review*, September 5, 1924, v. 109, p. 408. Coal fuels, wood and wood distillation, distillation of shale, peat, and other fuels are briefly discussed.

Relation of Fuel Oil System to Grade of Oil Used. 662.75
L. T. Bradley. *Fuels and Furnaces*, September 1924, v. 2, pp. 971-972. Urges maintenance of equipment and modification where necessary to burn cheap, heavy oil.

Industrial Methods

American Logging and Sawmill Safety Code. 674.02
Department of Commerce. Bureau of Standards, Washington, D. C. 140 pp. 60 cents. A safety code compiled by the safety engineering section of the Bureau of Standards. It has been approved by the Bureau and, as a tentative standard, by the American Engineering Standards Committee.

Cement. 666.94
(Höherwertige Zemente). Otto Graf. *Zeitschrift des Vereines Deutscher Ingenieure,* August 16, 1924, v. 68, pp. 853-856. Comparison of different cements' strength, and suggestions to manufacturers.

Charles Proteus Steinmetz. 92
J. W. Hammond. The Century Company, New York. 489 pp. $4. The authorized biography of a man whose life and achievements have been of great interest to the public and especially so to those engineers and scientists who could fully comprehend the true value of his work. The life story of Dr. Steinmetz closely parallels the history of the development and use of electrical energy to which he contributed so extensively. The story is told interestingly and, authoritatively. The book is well worth reading, for not the least important reason that, through the achievements of this penniless, deformed immigrant of 1889, this country is once more shown to be a real "land of opportunity".

Current Practice in Charges for Private Fire Protection. 614.84
H. A. Burnham. *Water Works* (Engineering and Contracting). September 1924, v. 62, pp. 591-593. Results of a questionnaire sent out by the Associated Factory Mutual Fire Insurance Co.

Farmer-Workmen Will Build Automobile of the Future. 629.113
Drew Pearson. *Automotive Industries,* August 28, 1924, v. 51, pp. 389-392. Illus. An interview with Henry Ford.

Fescolising, a New Method of Electro-Chemical Deposition of Metals. 621.372
The Engineer (London), August 15, 1924, v. 138, p. 193.

Heat Losses Through Insulating Materials. 691.82
R. H. Heilman. *Mechanical Engineering,* October 1924, v. 46, pp. 593-606. Diagrs. The problem of providing suitable pipe and boiler insulation, giving the results of numerous tests on commercial pipe coverings and insulating cements, and suggesting methods of determining the thermal conductivity of insulating materials.

Herrin Studies Employment Crisis. 622.33:338
The Black Diamond, August 23, 1924, v. 73, pp. 203-204. Report of a round table conference at the Lion's Club on the coal industry situation at Herrin, Ill.

Hopper Design for Automatic Machinery. 658.28
A. A. Dowd. *Machinery,* September 1924, v. 31, pp. 37-40. Diagrs. Designing hoppers to hold liquid or solid materials of varying substances.

A Hundred Years of Electrical Engineering. 621.3(09)
G. W. O. Howe. *The Engineer* (London), August 8, 1924, v. 138, pp. 166-168.

Improving the Efficiency and Reducing Cost of Ventilation. 697.9
C. W. Kimball. *Buildings,* August 27, 1924, v. 62, pp. 443-448. Diagrs. The recirculation system of ventilation described and recommended.

Industrial Possibilities of Liquid Oxygen. 661.9
L. E. Bedortha. *Acetylene Journal,* September 1924, v. 26, pp. 131-132, 134.

Inspection of Electric Elevators. 621.867
Warren Hilleary. *Power,* September 30, 1924, v. 60, pp. 539-540.

Lightning Arrester Application from the Economic Standpoint. 621.31515
A. L. Atherton. *Journal of the American Institute of Electrical Engineers,* September 1924, v. 43, pp. 813-817. Diagr.

Logarithmetic Diagram of Lathe Speeds and Feeds. 621.94
(Logarithmisches Diagramm zur Maschinenzeitbestimmung von Rundschleifmaschinen). Gustav Ganz. *Werkstattstechnik,* September 1, 1924, v. 18, pp. 461-463.

Principles of Business Conduct. 174:65
E. B. Parker. *Steam Coal Buyer,* September 1924, v. 2, pp. 15-17. Fifteen principles presented by the Committee on Business Ethics of the U. S. Chamber of Commerce.

Protection of Metals. 620.1224
(Metallschutz). E. Mass. *Zeitschrift des Vereines Deutscher Ingenieure,* August 23, 1924, v. 68, pp. 880-883. Discusses modern theories concerning corrosion; aluminum corrosion; and methods to protect metals.

Public Utility Regulation. 650.6
Morris Llewellyn Cooke. The Ronald Press Co., New York. 310 pp. $3.25. A collection of papers on the subject of public utility regulation. The authors are all familiar with public utility problems in their private as well as their public aspect. Subjects discussed include the field of regulation, service standards, bases of rate-making, cost finding as an aid to regulation, labor policies and public utilities, and nation-wide organization of the utility industries.

What's the Matter with Rubber? 678
R. A. Clemen. *Illinois Merchants Trust Company,* August 1924. Economic survey of the rubber industry during the last two decades.

Insurance

Fire Not the Only Hazard. 368
L. N. Boyd. *Credit Monthly,* October 1924, v. 26, pp. 12, 56-57. Insurance: against automobile accidents, forgery, loss of leadership in industrial firms, and others.

Under-Insurance and Credit. 368
W. M. Prentice. *Credit Monthly,* October 1924, v. 26, pp. 14, 55-56. Things a credit executive should know about insurance policies.

Use and Occupancy Insurance. 368
B. L. Whorf. *Credit Monthly,* October 1924, v. 26, pp. 16, 60-61. Describes the "fire use and occupancy insurance," its advantages and limitations.

Iron and Steel Industry

Electricity's Contribution to the Steel Industry. 669.187
K. A. Pauly. *Journal of the American Institute of Electrical Engineers,* September 1924, v. 43, pp. 831-839. Diagr. Outlines process involved in the production of steel, and characteristics of various rolling mills and types of motors used to drive them. Use of electricity as a means for economically using waste gases from blast furnaces.

The Iron and Steel Industry in Canada. 669.1(71)
C. S. Cameron. *The Engineer* (London), July 25, August 1, 1924, v. 138, pp. 112-113, 128-129. A historic and statistical survey.

Manufacture of Synthetic Foundry Iron in the Electric Furnace. 669.187
C. E. Sims and others. *Foundry Trade Journal,* August 28, 1924, v. 30, pp. 183-185.

Problems of Steel Mill Operation. 669.1
A. J. Whitcomb. *Industrial Engineer,* September 1924, v. 82, pp. 408-16, 456-57. Illus. Increased use of electrical and mechanical power-drive equipment, centralization and use of larger units for power generation, interest in ball and roller bearings on motors, and other tendencies found in large progressive steel works.

A Shop Laboratory That Improves the Product. 669.1(072)
C. O. Herb. *Machinery,* September 1, 1924, v. 31, pp. 1-3. Illus. Describes analysis of iron for iron castings and high quality obtained.

Maintenance

Application of Micrometers. 658.58
M. H. Williams. *Railway Mechanical Engineer,* September 1924, v. 98, pp. 553-558. Illus. Interchangeability of locomotive repair parts is made possible by using accurate measuring devices.

The Essentials of Lubricating Engineering. 658.581
A. F. Brewer. *Industrial Management,* September 1924, v. 68, pp. 145-151. Factors to be investigated in connection with steam cylinder lubrication; various methods of bearing lubrication; purification and storage of oil.

Maintenance: Gearing Up Both Plant and Equipment for Low-Cost Production. 658.58
Mr. Hamilton. *Factory,* September 1924, v. 33, pp. 332-35, 406. Functions of the maintenance department as related to plant and equipment. What the plant engineer should know.

Maintenance and Repairs on Industrial Equipment. 658.58
M. C. Cockshott. *Industrial Engineer,* September 1924, v. 82, pp. 436-37, 458.

Organization scheme for a maintenance department, incorporating the repair section. Shows that efficient maintenance reduces repair cost.

Modern Maintenance of Plant and Equipment. 658.58
W. G. Ziegler. *Industrial Management*, September 1924, v. 68, pp. 185-190. Maintenance in the power plant. Points to be kept in mind in the inspection and maintenance of boilers, piping, coal and ash handling apparatus, generators, recording instruments, etc.

Practical Hints on Oils and Machinery Lubrication. 658.581
W. E. Biggs and W. R. Woolrich. *National Engineer*, September 1924, v. 28, pp. 429-31.

Management

The Business Barometer. 658.1
W. J. Hiscox. *Business Organization and Management*, September 1924, v. 10, pp. 415-418. How the chief is kept in touch with things, by the daily report, giving a brief note of all happenings, under headings: letters received and sent, orders received and sent, goods returned, and miscellaneous.

Is the Big City Doomed as an Industrial Center? 658.112
J. A. Piquet. *Industrial Management*, September 1924, v. 68, pp. 139-144. Illus. Small cities, with comfortable homes and working conditions, and good transportation facilities, are rapidly becoming the industrial centers of the country.

Management's Handbook. 658
Edited by L. P. Alford. The Ronald Press Company, New York. 1607 pp. $7.50. This book, the first attempt to bring together in one place all available information concerning the organization and control of industrial operations, will be of great value to executives, to those working up to executive positions, and to students. It contains 32 sections written by men whose industrial experience and responsibilities give their words authority on the subjects they discuss. Every phase of industry is discussed, including policy, production, marketing, financial operation, and all interrelated activities of an industrial establishment. The book is divided into three main parts. The first group, containing, Sections 1 to 4, is devoted to general information such as tables, statistics, charts, graphs, management ratios, and mathematics. The second group, which includes the next 17 sections, deals with established management functions, methods and mechanisms. Here are discussed the industrial plant and its layout; office management; designs of forms, classifications, and symbols; purchasing and storekeeping; production control; materials handling; and similar subjects. The third group, of 11 sections, covers such basic information as economic principles underlying industry; business organization; budgetary control; cost accounting; banking and insurance; etc. General treatment and style of the book follows those features of engineering handbooks that have met with general approval. All information has been given in a way that makes it of most practical value for executives' use. An exhaustive index facilitates reference to any of the many subjects discussed.

Policies for Successful Operation. 658.1
B. A. Franklin. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 391-394. The success of a business depends greatly on the ability and vision of the executive. Considers service as well as profit.

Selling the Company to the Public. 658.1144
G. L. Myers. *Gas Age Record*, August 23, 1924, v. 54, pp. 255-257. The advantages of customer ownership of public utility companies, with statistics showing the increased number of stockholders in the electric companies of the Northwest.

Working Plans to Realize Profits: 1—Navigating a Business. 658
G. C. Harrison. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 361-366. Illus. The value and significance of scientific management. Compares the conduction of a business venture with the navigation of a ship; both have fair days and foul. Guess-work in business, dangerous like uncharted seas.

Management of Special Industries

Co-operative Railroad Shops. 658.9:625.2
(Austauschbau bei Eisenbahnwagen). Klein. *Zeitschrift des Vereines Deutscher Ingenieure*, September 13, 1924, v. 68, p. 965. Diagr. Urges need of co-operation among railroads in car maintenance and repair and in the use of the NDI.

Find Actual Cost of Castings. 658.9:621.72
G. B. Cocker. *The Foundry*, September 1, 1924, v. 52, pp. 665-666. How to arrive at a fair selling price. Method used by the Cocker Machine and Foundry Co.

Getting Castings Out on Schedule. Better Foundry Practice, No. 3. 658.9:621.72
Metropolitan Life Insurance Company. Group Insurance Division. Details concerning planning and controlling production in small and large foundry plants.

Paper and Pulp Manufacturing. 658.9:676
S. E. Thompson and W. E. Freeland. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 397-402. Charts. Job standardization, wage incentives, and bonus plans in the paper industry.

A Visit to a Well-Organized Railroad Blacksmith-Shop. 658.9:625.2
Railway Review, August 23, September 6, 1924, v. 75, pp. 271-277, 355-361. Illus. Equipment grouping and characteristic planning methods introduced in the South Louisville shop of the Louisville and Nashville Railroad. Floor diagram is given.

Material Control

Cutting Shipping Costs—With the Lightweight Container. 658.78844
H. W. Hawk. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 367-370. Illus. Describes wirebound boxes and their use in transportation.

How We Get 12 Turns a Year. 658.78
C. W. Nash. *Factory*, September 1924, v. 33, pp. 329-331, 366. Shows the advantage of rapid turnover of raw materials in a manufacturing plant. How one concern kept only one month's supply ahead.

A Practical System of Tool Storage and Control. 658.563
F. A. Pope. *Factory*, September 1924, v. 33, pp. 346-47, 420.

A Well-Planned Tool System. 658.563
Pt. 2. *Engineering Production*, September 1924, v. 7, pp. 268-271. Illus. Comprehensive plan for a tool department covering control from purchase to replacement. Numerous record cards are given.

Mechanical Handling

Conveyor Systems. 658.281
(Transportwesen im Werkstattbereich). *Werkstattstechnik*, August 15, 1924, v. 18, pp. 432-435. Power conveyors are divided into three groups of which the first, conveyors with a horizontal motion, are described.

Conveyors Handle Chewing Gum. 658.281
W. B. Ranney. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 387-390. System in the Wrigley Company Chicago plant.

Handling Materials by Cable Conveyor. 658.281
M. W. Potts. *Industrial Management*, September 1924, v. 68, pp. 170-177. Illus. Shows the wide field in which cables can be advantageously applied to handling equipment,—cable flight conveyors, skip hoists, monorail systems, aerial tramways, etc.

Handling Materials in Modern Glass Plant. 658.281:666.1
L. M. Ewell. *Belting, Transmission, Tools and Supplies*, September 1924, v. 25, pp. 48, 50-52, 54. Illus. ' Complete system installed in the plant of the Owen Bottle Co., Charleston, W. Va.

Industrial and Commercial Applications of the Tractor. 658.281
G. D. Babcock. *Journal of the Society of Automotive Engineers*, September 1924, v. 15, pp. 199-205. Illus.

Large Savings Effected by Coal Handling Plant at Detroit. 658.281:662.65
W. D. Haarer. *Water Works* (Engineering and Contracting), September 10, 1924, v. 62, p. 561. Cost of fuel handling equipment and its operation at Fairview Pumping Station compared with costs prior to mechanical installation.

Steam Jet Ash Conveyor. 658.281:621.18
C. H. S. Tupholme. *Cassier's Industrial Management*, September 1924, v. 11 (new series), pp. 427-428. Points to be borne in mind in installing steam jet ash conveyors in the boiler room.

Office Methods

The Business Library. 65(016)
J. C. Dana. *Credit Monthly*, October 1924, v. 26, p. 45. A list of 100 books constituting a library for the use of business executives.

Business Writing. 651.74
S. Ronald Hall. McGraw-Hill Book Co., Inc. New York. 222 pp. $2.50. Discusses essentials of various forms of business writing such as magazine articles, newspaper items, copy for house organs, reports, and advertising copy. Illustrated with numerous examples of business writing that have been published in the past. Considerable information on the proper methods for selecting subjects, gathering data, preparing the article, and marketing it, is given. The book should be of value to present or would-be writers.

Decimal System in Subject Filing. 651.53
Craig Saxon. *Canadian Manufacturer,* August 1924, v. 44, pp. 23-24. Its advantages and disadvantages for the business office explained.

How Shall We Equip the Office? 651.2
W. D. Bruner. *Business,* October 1924, v. 6, pp. 15-17. Illus.

When We Put the Office on Paper. 651
W. D. Bruner. *Business,* September 1924, v. 5, pp. 13-15, 50. Practical methods for making the office arrangement fit the work to be performed. Points out the value of the organization chart showing the relationships of personnel and of work; and the flow of work chart showing the physical travel of the major routines.

Personnel

Discussion on Employee Representation. 658.3151
A. H. Young. *Iron Age,* September 18, 1924, v. 114, pp. 689-91.

Employee Stock Ownership. 658.3174
(Beteilung von Werksangehörigen am Betriebskapital). Franz Goerrig. *Werkstattstechnik,* September 1, 1924, v. 18, pp. 467-469. Makes special reference to the Krupp works experiment started in 1921.

The Employee's Past. 658.3115
D. A. Laird. *Industrial Management,* September 1924, v. 68, pp. 152-160. Diagrs. Character and ability rating. Emphasizes the value of reliable records of employees, both before and after entering a firm.

An Experiment in the Validity of Judging Human Ability. 658.31154
A. J. Snow. *Journal of Applied Psychology,* September 1924, v. 8, pp. 339-346. Tables. Illustrating that the current method of judging ability by means of the personal interview is unsatisfactory.

Here's How to Take Up the Slack. 658.3
Philip Welch. *Business,* October 1924, v. 6, pp. 50-51. Adapting individuals to tasks and tasks to individuals, the work of the Utilities Bureau of the Metropolitan Life Insurance Co.

How a Personnel Department Aids Cooperation. 658.3
E. M. Harris. *Railway Age,* August 23, 1924, v. 77, pp. 323-325. Stabilized employment, ameliorated conditions, and increased recreation and training the result of its installation in the railway systems.

Industry's Human Element Waste. 658.3
Seth Seiders. *Michigan Manufacturer and Financial Record,* September 27, 1924, v. 34, pp. 4, 24-25. Introductory article on the tremendous loss to industry through absenteeism, mistakes, loafing, discontent, labor turnover, etc.

Policies for Successful Operation. 658.31242
B. A. Franklin. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 391-394. The success of a business depends greatly on the ability and vision of the executive. Considers service as well as profit.

A President's Letters to His Workers. 658.315
G. F. Johnson. *System,* October 1924, v. 46, pp. 441-445, 495. Illus. Letters emphasizing the need of co-operation, understanding and loyalty between employer and employee.

Suggested Tests for Senior Clerk. 658.311562
F. A. Moss and Fred Telford. *Public Personnel Studies,* September 1924, v. 2, pp. 195-213. Nine ability tests covering arithmetic, reading, alphabeting, business terms, general education and understanding, etc.

Taking the Bank to the Factory. 658.384
H. B. Bliss. *Michigan Manufacturer and Financial Record,* September 6, 1924, v. 34, pp. 3, 26. Plan is to take a definite sum from pay envelope and put it to the savings account of employee. Lansing bank created 3000 new accounts in this way.

Tests for Shop and Office Jobs. 658.311563
B. P. Campbell. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 409-412. Describes five tests and methods of checking accuracy, used in the General Electric Company at West Lynn.

Voluntary Motor Ability of the World's Champion Typists. 658.31156
W. F. Book. *Journal of Applied Psychology,* September 1924, v. 8, pp. 283-308. Tables, diagrs. Experimental tests given to the champion typists indicate that an unusual degree of voluntary motor control is a necessary factor for attaining the highest levels of success in typing, and in learning to typewrite.

Why We Make Up the Pay-Roll in the Employment Office. 658.312
Merrill R. Lott. *Factory,* September 1924, v. 33, pp. 338-39, 405. Savings effected in records, labor, etc., by combining these two departments.

Power and Power Plants

Belting Materials. 658.2621
G. A. Frenkel. *Machinery,* September 1924, v. 31, pp. 14-16. Diagr. The physical properties and general characteristics of leather, rubber, cotton and steel belting, with an evaluation of each.

Central Station vs. Industrial Power Plants. 621.311
W. J. Risley, Jr. *Power Plant Engineering,* September 1, 1924, v. 28, pp. 896-897.

A Comparison of Group and Individual Drive. 658.26
R. W. Drake. *Industrial Management,* September 1924, v. 68, pp. 178-183. An evaluation of relative advantages and disadvantages of the two drives. Suggestions to aid in a choice in cases where either might be used.

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Gordon Simmons. *Power Plant Engineering,* September 1, 1924, v. 28, pp. 906-908. Illus. Diagrs.

Economy Secured by Heating Feed Water. 658.26
C. E. Colborn. *Power Plant Engineering,* September 15, 1924, v. 28, pp. 946-947.

The Executive and His Power Department. 658.26
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Generating Steam from Waste Heat. 658.26
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How Belting Was Standardized in a Large Automotive Plant. 658.2621
H. A. Flogaus. *Belting, Transmission, Tools and Supplies,* September 1924, v. 25, pp. 25-27.

How Much Power is That Rubber Belt Transmitting? 658.2621
W. F. Schaphorst. *Belting, Transmission, Tools and Supplies,* September 1924, v. 25, pp. 29-30. Table. Simple method of computing horsepower, based on the sag on the tight side and on the slack side.

Industrial Electric Heating for Central Stations and Manufacturers. 621.311
W. R. Putnam. *National Electric Light Association Bulletin,* September 1924, v. 11, pp. 578-582.

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L. W. Arny. *Paper Trade Journal,* September 4, 1924, v. 79, pp. 43-47. Illus. How to join the two ends of the belt to make a continuous length; how to shorten narrow belts which have been endless; cements used.

Mechanical Stokers. 621.18214
Robert June. *The Blast Furnace and Steel Plant,* August 1924, v. 12, pp. 385-388. Illus., tables. Advantages and economies derived from their use at small boiler plants.

Methods of Operation at the Paterson Parchment Paper Co. 658.26
Power Plant Engineering, September 15, 1924, v. 28, pp. 932-936. Illus. Efficiency and economy as shown in the operation of the power plant of the company.

Modern Practice of Exhaust Steam Utilization in Germany. 662.992
(Gegenwärtiger Stand der Abdampftechnik und Abdampfwirtschaft in Deutschland). H. Treitel. *Zeitschrift des Vereines Deutscher Ingenieure,* August 30, 1924, v. 68, pp. 896-901. Illus.

Operation of Steam Boiler Plants. 621.18
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Power Consumed in Rolling Steel. 621.944
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Problems of Steel Mill Operation. 658.26
A. J. Whitcomb. *Industrial Engineer,* September 1924, v. 82, pp. 408-16; 456-57. Illus. Increased use of electrical and mechanical power-drive equipment, centralization and use of larger units for power generation, interest in ball and roller bearings on motors, and other tendencies found in large progressive steel works.

Some Notes on Line Shafting. 658.262
H. Seymour. *World Power,* September 1924, v. 2 (new series), pp. 170-172. Suggestions for installing shafting so as to increase economy and efficiency in a power transmission system.

Production Control

Complete Gaging System Fosters Pride in Maintaining High Quality. 658.562
W. L. Carver. *Automotive Industries,* September 11, 1924, v. 51, pp. 472-76. Illus. Accuracy of work made possible by dimensional and other gages for testing all parts manufactured in the plant of the General Motors Truck Company.

Factors in Industrial Organization. 658.56
R. Wendorby. *Cassier's Industrial Management,* September 1924, v. 11 (new series), pp. 409-10. Characteristics of the works or department manager, necessary to develop all possible resources, and to eliminate wastage.

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Better Foundry Practice, No. 3. Metropolitan Life Insurance Company. Group Insurance Division. Details concerning planning and controlling production in small and large foundry plants.

Handling Driving Box Work. 658.56
J. H. Hahn. *Railway Mechanical Engineer,* September 1924, v. 98, pp. 549-552. Illus. Grouping machine tools and handling the work in a manner that time and labor will be saved in the various operations.

How American Radiator Forecasts Future Sales and Advertising. 658.571
Warner Bates. *Printers' Ink Monthly,* October 1924, v. 9, pp. 17-18, 108.

Making and Using Time Studies. 658.5421
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R. S. Emmet. *Factory,* September 1924, v. 33, pp. 340-42, 386. Methods of sorting and disposing of scrap metal profitably, at the Schenectady works of the General Electric Company.

Our Nine Gains from "Planned Production". 658.513
George A. Meihaus. *Factory,* September 1924, v. 33, pp. 343-44, 432-33. Schedule boards used to give uniform output throughout the year, stabilizes working force and avoids congestion.

Putting Orders Through the Shop—Building Tractors Under Scientific Management—V. 658.5
G. D. Babcock. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 377-382. Close co-operation between departments results in suggestions on readjustments that will facilitate production and reduce costs. Charts are given that show routine followed and forms used for scheduling work.

To Cut Waste of Unemployment. 658.5
H. S. Dennison. *The Nation's Business,* October 1, 1924, v. 12, pp. 32-34. Illus. Dennison methods of production control and sales distribution to level seasonal demands and minimize unemployment.

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Allocating the Cost of Selling. 658.8
F. A. R. Paxton. *Sales Management* (English), July 15, 1924, v. 4, pp. 352-354. Urges separation of manufacturing and selling expenses and discusses factors that establish selling cost.

Automobile Expense Control Plans Used by U. S. Gypsum Co. 658.846
E. W. Dunham. *Sales Management,* September 1924, v. 7, pp. 1473-1474, 1536. Sales calls increased fifty per cent after automobiles were put in use. Periodical inspection saves emergency repairs and cuts maintenance costs.

Business Itinerary. 658.81
(Technik der Reiseberichte). S. Gans. *Werkstattstechnik,* August 15, 1924, v. 18, p. 429. Firm representative or salesmen should make uniform and detailed reports. Forms for standardization are given.

The Collection as a Sale. 658.88
J. N. Griffith. *Credit Monthly,* September 1924, v. 26, pp. 14, 30. Suggestions for credit managers' letters, properly constructed to sell the debtor the idea of prompt payment.

Developments in Scientific Methods for Selecting Salesmen. 658.81
H. G. Kenagy. *Sales Management,* September 1924, v. 7, pp. 1453-1454, 1560.

Effective Collection Letters. 658.88
J. H. Tregoe, LL.B. and John Whyte, Ph.D. Prentice-Hall, Inc. New York. 514 pp. $4. Consists of over 300 collection letters taken from the files of some 50 business concerns. These letters have been successful and are presented as examples of methods that get results. Letters to meet practically every collection situation are included. An interesting addition is a number of exchanges between debtors and creditors illustrating debtor reactions to collection letters, and how the creditor obtains payment.

The Hardest Job for the Sales Manager. 658.811
A. H. Deute. *Printers' Ink,* September 18, 1924, v. 128, pp. 17-20. Methods of working out the problem of getting results out of the force of salesmen calling on the retail trade.

Have Manufacturers Gone Too Far in Giving Service? 658.82
E. W. McCullough. *Printers' Ink,* September 11, 1924, v. 128, pp. 69-70, 72. The question of legitimate service, or helps in connection with actual use of a commodity, to give satisfaction to the customer.

How Often Do You Add New Names to Your Mailing List? 658.81
Maxwell Droke. *Printers' Ink,* September 18, 1924, v. 128, pp. 57-58, 60. Successful methods employed by firms, for securing new names.

How to Turn Salesmen Into Sales Managers. 658.87
C. C. Casey. *Printers' Ink,* September 11, 1924, v. 128, pp. 57-58, 60. To show dealers how to make sales and to keep them selling—the real job of the salesman. Orders will then take care of themselves.

The Idea-Getting Man. 658.811
E. T. Fanning. *Credit Monthly,* September 1924, v. 26, p. 17. The value to the credit man of new ideas, facts, and methods furnished by current books and periodicals.

Inter-departmental Co-operation. 658.81
H. E. Colesworthy. *Business Organization and Management,* September 1924, v. 10, pp. 409-413. Suggestions for securing greater co-operation between the sales and accounts departments.

It's Easier to Fight the House Than the Customer. 658.856
V. V. Lawless. *Advertising and Selling Fortnightly,* August 27, 1924, v. 3, pp. 17, 40-41. Shows that a house saves money by investigating claims made to its salesmen by customers, for allowances and deductions on purchases. Unfair claims are thus eliminated.

Marketing American Goods in Italy, Spain, and Belgium. 382
C. W. Gerson. *Advertising and Selling Fortnightly,* September 10, 1924, v. 3, no. 10, pp. 15, 44, 46. A few facts concerning the different countries, to be kept in mind when seeking to market a product.

Marketing the Technical Product. 658.8
E. N. Simons. *Mechanical World,* August 8, 1924, v. 76, pp. 85-86. Makes special reference to advertising in foreign countries, what points to emphasize, the language problem and value of the trade mark.

Meeting the Retailer's Argument Against Quality and High Price. 658.87
Roland Cole. *Printers' Ink,* September 25, 1924, v. 128, pp. 85-86, 88. How one company got an appreciation of quality into the minds of the retailer and the customer, and educated the retail salespeople in selling methods.

The Modern Sales Manager and His Never-Ending Job. 658.811
E. J. Manning. *Advertising and Selling Fortnightly,* September 24, 1924, v. 3, p. 34.

Organizing the Credit Department. 658.882
J. W. Hallman. The Ronald Press Company, New York. 80 pp. $1.25. Detailed instructions for the organization and oper-

ation of a credit department. Discusses sound procedure in credit and collection work, the preparation and use of records, and relations of the credit manager with other departments, with the general management of the business, and with outside agencies. Provides, in usable form, authoritative information which bears directly on the problems arising in the credit man's work.

Premium Plan Increases Sales 500 Per Cent. 658.821
Lee R. Fleming. *Sales Management,* September 1924, v. 7, p. 1502. Trick accomplished by "A bag of marbles free in Flyer, Jr., Overalls".

Principles of Merchandising. 658.87
Melvin Thomas Copeland, Ph.D. A. W. Shaw Company, Chicago. 368 pp. $4. In order to reduce the present high cost of marketing, the author believes it will be necessary to recognize and apply sound merchandising principles. This book builds up a comprehensive body of marketing theory, substantiated by experiences of numerous concerns, and explains their applications to every-day problems. Much of the book is devoted to retail selling but there is also considerable material that will be valuable to manufacturers.

Rejuvenating an Ailing Prospect List. 658.81
W. E. Backus. *Printers' Ink,* September 11, 1924, v. 128, pp. 33-34, 36. Methods employed by a dealer in wholesale floor coverings for getting results from broadsides, letters, etc., for keeping the mailing list classified by legitimate prospects and possibilities, and for constant weeding out and regrouping.

Sales Jumped When We Told Buyers How to Use Our Products. 658.82
E. M. Wickes. *Sales Management,* September 1924, v. 7, pp. 1457-1458, 1530.

The Sales Manager—Slave or Slave Master? 658.8462
G. M. Meyncke. *Printers' Ink,* September 18, 1924, v. 128, pp. 169-170. Points out the possible abuses of the straight commission system of paying salesmen.

Securing Maximum Profits from New Territory. 658.808
Ralph Crothers. *Printers' Ink,* September 11, 1924, v. 128, pp. 121-122, 124.

The Selling End. 658.8
A. E. Bull. *Business Organization and Management,* September 1924, v. 10, pp. 421-425. How the British realize that sterling reputation and quality, rather than glib salesmanship, is the basis of success in foreign trade and in the securing of a continuous repetition of orders.

Textbook of Salesmanship. 658.85
Frederic A. Russell. McGraw-Hill Book Co., Inc., New York. 319 pp. $3. A collection of selling principles that have been tried and tested by practical salesmen in various lines. It contains a large number of quotations from other papers on the subject. These have been included with the idea of giving the reader an acquaintance with the vocabulary of the salesman and to give the views and opinions of successful salesmen and sales managers. Although designed primarily as a textbook it contains much information of value to salesmen of all kinds.

What a Manufacturer Learned from House-to-House Selling. 658.87
A. E. Mihell. *Printers' Ink,* September 25, 1924, v. 128, pp. 129-130, 132. A canvasser, provided by the manufacturer for the disposal of retailers for a certain period, revealed the possibilities for retailers, if they co-operate with the manufacturer in going after business.

What Is Wrong With Our Distributing Machinery? 658.87
R. F. Davidson. *Advertising and Selling Fortnightly,* September 24, 1924, v. 3, pp. 25-26, 68-69. Suggests that jobbers be jobbers and not try to branch into work not belonging to their field.

Where to Find the Big Constructive "Sales Argument". 658.821
Roland Cole. *Printers' Ink,* September 18, 1924, v. 128, pp. 137-138, 140. How Strong-Hewat & Co. put an original note into their selling policy for "Virgin wool" products.

Why Our Business Didn't Suffer When We Discontinued Our Guarantee. 658.82
Edward Freschl. *Sales Management,* September 1924, v. 7, pp. 1455-1456, 1557. Successful selling and distribution methods employed by the Holeproof Hosiery Co.

Standardization and Research

Foreign Progress in Cutting Metals. 62(003)
C. A. Beckett. *Mechanical Engineering,* October 1924, v. 46, pp. 618-624. Illus., diagrs.

The Government and the Machine Tool Industry. 62(003)
G. K. Burgess. *American Machinist,* September 25, 1924, v. 61, pp. 513-515. The work of departments, bureaus, and associations in formulating specifications for materials, performance of machines and instruments, and preparing standards of practice and safety codes.

Some Notes on Measurements and Approximations. 389
George S. Duncan. *The Cost Accountant,* July 1924, v. 4, pp. 58-64. Illus. Showing that all measurements are approximations, and emphasizing the need of carefully manipulating the figures expressing these measurements.

Standardization of Tool Steel. 62(003)
(Beitrag zur Normung der Schneidstähl). Richard Nerrlich. *Werkstattstechnik,* September 1, 1924, v. 18, pp. 463-466.

Training

Apprenticeship Methods on the Sante Fe. 658.3861
Railway Mechanical Engineer, September 1924, v. 98, pp. 527-531. Illus.

A Training Program for the Factory Foreman. 658.31243
J. K. Novins. *Open Shop Review,* September 1924, v. 21, pp. 331-336. Article 10: The Federal Board plan for foreman training.

Why We Hire Young Men and How We Train Them. 658.386
N. B. Hickox. *Sales Management,* September 1924, v. 7, pp. 1447-1448. A year's training program developed by the Curtis Lighting, Inc.

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The American Railroad Problem. 656.2
C. Donnely. *Railway Review,* September 20, 1924, v. 75, pp. 431-433. Shows how government ownership has been a failure when compared with the results achieved by private operation.

Motorbus Transportation. 656.124
A. E. Hutt. *Journal of the Society of Automotive Engineers,* September 1924, v. 15, pp. 251-258. Underlying principles are outlined and suggestions are made concerning features conducive to successful operation, as design and construction, maintenance, courteous employees, protective franchises, etc.

Railway Transportation; Principles and Point of View. 656.2
Sidney L. Miller, Ph.D. A. W. Shaw Company. Chicago. 905 pp. $4. A comprehensive review of the entire railway transportation problem. First is given a discussion of the relation of transportation facilities to social and trade development. Then follows a history of railway growth in the United States including the existing ownership and territorial groupings. Discussion of railway service including personnel, organization freight and passenger charges, comprises the third section. Economics of railroad enterprises follows with discussions of competitive combination, expenses, revenues, rate-making, etc. The final section treats regulation of railways. This is an interesting and instructive work which is an important addition to transportation literature.

Southern Transportation Facilities. 656.2(75)
R. G. Macy. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 403-408. Maps. Development of roads and railroads in the Piedmont section of the Carolinas, and their service and co-operation with local industries.

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An Equitable Plan for Paying Office Workers by Results. 658.3231
P. H. Wilson. *System,* October 1924, v. 46, pp. 425-428. Illus. A description of the premium wage plan used by the Graton and Knight Manufacturing Company.

Profit-Sharing and Recent French Legislation. 658.324
Paul Pic. *International Labor Review,* July 1924, v. 10, pp. 1-29. Discusses the French Act of April 1922 on joint stock companies with profit-sharing schemes, and compares it with previous acts concerning themselves with labor conditions making special reference to the Act of 1917.

CONDITIONS AND PROSPECTS IN BUSINESS AND INDUSTRY

Business Improves: Need for Sanity

Prepared by LEWIS H. HANEY

Director, New York University Bureau of Business Research[1]

The P/V line in Fig. 1 is the main forecasting line of general business prospects and its relative vertical position on the chart at any month shows whether business will be good or bad at a period 4 to 6 months later. The trend of the P/V line in October continued practically on a level with September. In a general way this suggests a slackening in business early next spring, which will be of at least moderate proportions. Accordingly, it seems probable that there will be a reaction in the stock market in the near future (perhaps before this appears in print). There is yet, however, no indication of a major downward turn in the business cycle and no such downward turn is here forecast.

In the November issue of Management and Administration it was indicated that the strain of an approaching readjustment in international trade would begin to be felt some time next year. It is not possible, however, so far in advance to express any opinion as to when the trouble will become acute, and it may not become so until 1926. It does seem clear that the next major depression will be characterized by foreign competition, an outflow of gold, and falling prices resulting therefrom.

With regard to the more immediate future, the P/V line indicates that the price level of commodities is approaching a point where it may be doubted whether the growing rate of consumption and business can be long maintained. Production volume has increased so sharply that it will probably be only 3 or 4 months at most when a normal level is exceeded. Once beyond that level, downward readjustment will soon become necessary. The only conditions which will make possible a more sustained advance will be a further development of inflation resulting in continued advances in commodity prices. In short, it is to inflation that one must look for justification of the hopes of those who at this time anticipate a prolonged business boom.

Commodity prices have advanced about 9 per cent since July 1. The level of prices on the stock exchange and on the Chicago Board of Trade is very high and speculation has been feverish at times. The public is participating to an increasing extent and a dangerous spirit of optimism is rapidly gaining headway.

It is clear that inflation has already begun and unless speedily checked, it will soon carry business sharply upward, with the inevitable crash to follow.

As moderating factors there are: (1) The checking of gold imports and the probability that gold exports will begin later on; (2) the volume of production of commodities is rapidly gaining and the expanded volume of business transactions will normally require a greater amount of money and credit; (3) there is also a widespread knowledge of business conditions and continued discussion of inflation and its dangers which must tend to preserve greater sanity in business than obtained in 1919.

In view of the foregoing situation it is extremely difficult to strike a balance. If the speculative, inflationary fever gains, we might have a regular business boom which would probably reach a peak some time after the middle of 1925.

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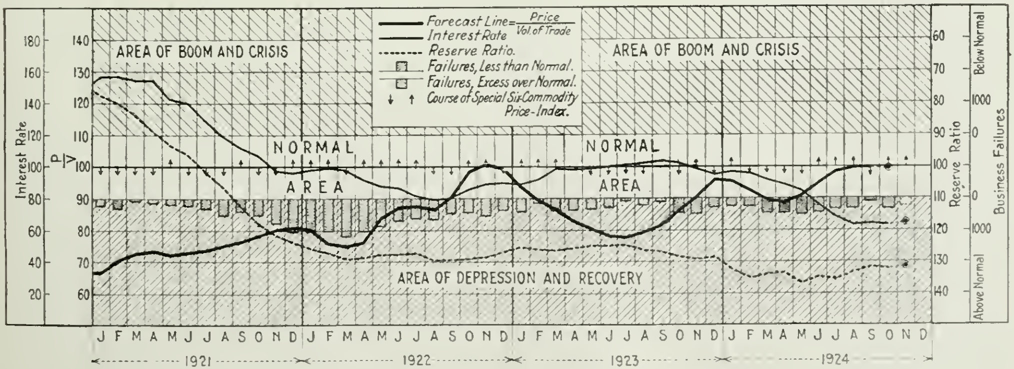
[1] Assisted by Horace J. Barney, R. H. Leding and Harry Corash, of the Bureau's Staff.



Data on the compilation of this curve can be obtained upon request to the editors. November data are estimates.

Fig. 1 The Barometer of Industry and Trade

If this development does not occur, the present indications are that business will continue to improve until the spring of 1925 and then undergo a moderate readjustment.

It is to be doubted if the purchasing power of consumers is sufficiently high to enable a development of a great boom peak in business next year. In spite of the great improvement in the income of grain farmers, we do not consider that the purchasing power of the total farm population is sufficiently high to support such a peak. The Bureau's index of the purchasing power of labor is appreciably below where it stood at the peak of 1923 and does not seem likely soon to attain the 1923 level. Moreover, the preceding period of hand-to-mouth buying has prevented any great depletion of dealers' stocks, and the amount of deferred buying is not so large as usual at the end of depressions.

To sum up, it seems most probable that the present inflationary trend will be checked rather early, much as it was in 1923, and will be followed by a reaction which will be somewhat greater than if there were no inflation, but will not be so great as that of 1921. The question is, "When?" Frankly, it is not believed that anyone is in a position to answer that question, but we venture the tentative opinion that it will not come earlier than 5 months from now, nor later than the summer of 1926.

As already stated, the failure of the main forecasting line to continue its upward trend indicates that the present upswing in business will be checked in a few months; but, meanwhile, the favorable forecast registered by that line beginning in May will continue to be borne out in a rising business trend. The recent developments in October down to the middle of November have been, on the whole, constructive.

RECENT DEVELOPMENTS

1. The election return has given a decided setback to the radical forces and the danger of unsound legislation during the next session of Congress has been materially reduced.
2. Partly as a result of the foregoing there has been a decided increase in optimism, and improved sentiment is apparent in most lines of business, and the result should be a freer placing of orders. The favorable money situation and relatively small stocks of commodities will now find expression for a time in a more rapid business expansion.
3. Sharp gains in the stock and produce markets accompanied by a large increase in public participation.
4. The gain in the level of commodity prices during October was sharper than in September (Fig. 12).
5. Allowing for seasonal variation, two of the important indexes of trade decreased in October—mail-order sales and bank debits (Fig. 11).
6. There was a considerable increase in the number of business failures during October, while new enterprises decreased somewhat after seasonal adjustment (Fig. 13).

The outstanding fact is a change in sentiment.

FAVORABLE FACTORS

1. Improved political situation.
2. Low money rates (Fig. 12).
3. Unfilled orders in many industries show small gains, including the steel industry (Fig. 3).
4. Building activity held up well (Fig. 6).
5. Employment and earnings of labor increased (Figs. 7, 8 and 9).

UNFAVORABLE FACTORS

1. Unseasonably warm weather has given a setback to retail trade and to the coal industry, while helping the demand for gasoline (Figs. 5 and 11).
2. Bank debits continued the downward trend of September and mail-order sales decreased, after seasonal adjustment (Figs. 10 and 11).
3. Production in basic industries increased faster than railway tonnage, indicating the trend toward stock accumulation (Fig. 2).
4. The index of commodity stocks compiled by the Department of Commerce increased in September and is back to the level of last spring (Table 1).

FUTURE DANGERS

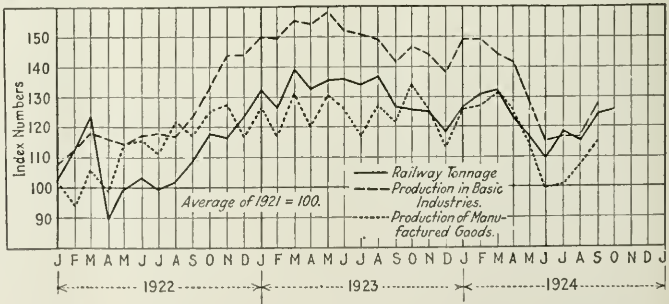
1. Inflation has begun, with the corresponding probability that contraction will become necessary.
2. Stocks of commodities in basic industries have not been thoroughly liquidated and may soon begin to pile up as a result of speeding up production too soon.
3. The cost of living is on the increase and may easily become so high, relative to per capita earnings, as to curtail purchasing power seriously (Fig. 7).
4. The sharply increasing demand for funds, especially for speculative purposes, may soon cause an upturn in money rates—even if this event is not hastened as a matter of banking policy. The index of interest rates has shown signs of a turn (Figs. 1 and 12).
5. Ultimately, exports of gold and increased foreign competition will automatically bring an end to any boom period which may come.

The increasing cost of living is now an important factor to watch. Prices of clothing and housing are out of line with other prices and take so large a percentage of the average consumer's income that his surplus available for miscellaneous purchases is small. While there has been some equalization during the last year, this maladjustment still exists. With clothing and building materials again on the upgrade, and with food costs rising, the situation may handicap business recovery.

Production and Stocks of Commodities

Production Gaining: Danger of Stock Accumulation

The stocks of basic commodities shown in Table 1 moved irregularly. Most of the commodities covered, however, showed decreases, with gasoline and tires as exceptions. Gasoline stocks are far too large. Leather, sugar, and



Sources, Federal Reserve Board; N. Y. U. Bureau of Business Research. Railway tonnage and production in basic industries corrected for seasonal variation, and the latter also for normal growth.

FIG. 2 RAILWAY TONNAGE AND PRODUCTION IN INDUSTRY

TABLE 1. STOCKS OF IMPORTANT COMMODITIES ON THE FIRST OF THE MONTH
Average for 1921 = 100. Gasoline, raw sugar, cottonseed oil and Dept. of Commerce index adjusted for seasonal variation.

MONTH AND YEAR	GASOLINE	LEATHER (Cattle)	ZINC	NEWSPRINT PAPER	AUTOMOBILE TIRES	RAW SUGAR	COTTONSEED OIL	MERCHANT PIG IRON	DEPT. OF COM. INDEX OF STOCKS—45 COMMODITIES
	100 = 630,757,000 gals.	100 = 19,742,000pieces	100 = 77,202 tons	100 = 30,009 tons	100 = 4,364,000 tires	100 = 114,000 tons	100 = 255,400,000 lbs.	100 = 634,950 tons	100 = 132
Jan. 1923	156	85.3	23.6	64.0	105.4	55.0	52.0	35.8	87.7
Feb.	156	84.0	21.5	76.7	107.6	76.0	60.0	43.0	84.1
Mar.	154	82.6	14.1	77.3	119.7	86.0	64.5	44.0	84.8
Apr.	162	81.6	13.0	67.2	129.9	168.0	67.0	38.0	84.8
May	164	81.4	11.6	62.9	139.3	147.0	69.0	41.7	80.4
June	173	82.1	16.9	60.5	159.6	97.0	71.0	53.6	83.3
July	174	82.8	22.2	65.0	161.4	97.0	76.0	72.7	82.6
Aug.	185	83.6	27.5	74.0	148.0	96.2	74.0	97.5	90.6
Sept.	199	84.3	34.4	85.5	138.5	81.8	57.4	111.0	95.5
Oct.	206	84.2	29.6	82.2	123.2	130.4	28.0	121.7	85.5
Nov.	211	85.4	33.4	82.4	111.7	102.8	43.0	131.0	88.4
Dec.	202	85.8	40.3	80.0	107.5	89.8	43.3	141.0	90.6
Jan. 1924	186	87.0	47.3	78.8	99.0	79.0	52.5	145.0	98.6
Feb.	187.5	79.5	52.7	94.6	110.0	54.5	53.5	144.5	97.8
Mar.	188	83.8	48.0	101.0	120.5	90.0	58.5	140.0	98.6
Apr.	203	81.2	41.5	103.0	132.0	143.0	60.2	139.5	98.6
May	197	77.2	42.5	105.6	141.3	125.6	63.2	148.6	102.9
June	214	78.0	54.9	114.9	140.1	99.4	62.4	158.8	95.7
July	220	77.0	64.3	111.4	141.1	108.9	68.2	164.2	94.9
Aug.	232.5	75.0	68.3	94.8	117.7	114.7	56.9	165.6	97.1
Sept.	250.3	71.0	66.0	94.0	102.6	82.1	45.1	157.2	98.5
Oct.	259.8	67.9	59.2	....	103.7	77.2	34.6	....	..
Nov.	....	....	49.8	....	....	41.8	....	....	

cottonseed oil stocks indicate greater strength in those industries. The Department of Commerce composite index increased in September for the second successive month. This is an unfavorable symptom and is to be connected with the sharp upturn in production in basic industries. It raises the question, Will demand develop in proportion?

Production and Railway Tonnage

Production. The index of production in basic industries moved up 9 per cent in September (Fig. 2). This is a gain of 28 per cent over the 1921 average, but the index was 18 per cent under the 1923 peak. Manufacturing production also increased considerably in September, the index rising to 115.4.

Railway Tonnage. The traffic of Class 1 Railways was approximately 133 million tons in October against 122 million in September, a total gain of 33 per cent from the 1924 bottom level.

Conclusion. There has obviously been a sharp upturn in the general physical volume of production. Nevertheless, the industrial output is considerably below peak levels and there is every indication of further gains. The adjustment between basic production and railway shipments is still fairly close and there is apparently no great accumulation of excess stocks in first-hands. Railway traffic in October gained a little more than the normal seasonal increase, but did not keep up the pace set in September. The sharp upturn in the index of production suggests the danger of increasing output too rapidly.

Iron and Steel Production

Production. The upward trend of production, which started in August, continues (Fig. 3). The average daily rate of production of steel ingots increased 6 per cent, while pig iron showed an 18 per cent rise, which, after seasonal adjustment, was 15 per cent.

Unfilled Orders. Unfilled orders of the United States Steel Corporation failed to show more than a normal gain. However, relatively large production and shipments, together with the pre-election halt in buying, were probably responsible for the failure of unfilled orders to make a more favorable showing. The subsequent placing of large orders for pig iron by certain interests indicates that buyers were awaiting the outcome of the election.

Prices. Prices of scrap, pig iron, and finished steel products were immediately advanced, and although there was no rush to place orders for steel at advanced quotations, inquiries were numerous, indicating improved interest and sentiment.

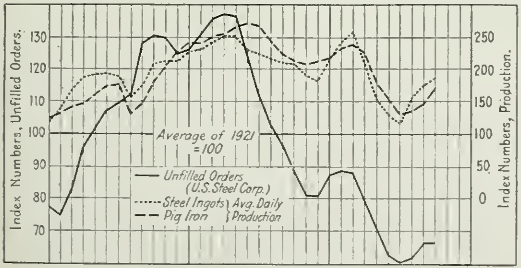
Conclusion. We look forward to continued improvement in the iron and steel situation. Production, in the face of maintained demand, should show further increases, with pig iron gaining more rapidly than steel ingots.

Prices of pig iron and finished steel will continue to advance, with pig iron showing a relatively sharper rise. We expect this advance to be maintained at least until late January or February.

Beyond this date it is impossible to forecast definitely with information now at hand. The actual course of business in 1925 will depend upon whether inflation is permitted to run its course, or whether bankers and business men are cautious enough to apply the brakes.

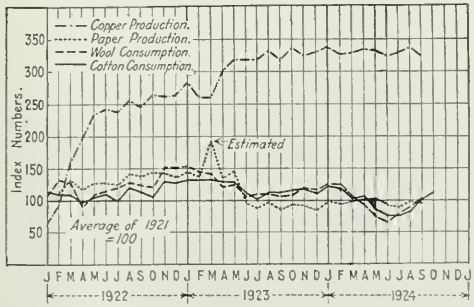
Production in Important Industries

Copper. Copper production showed a decline of 4.4 per cent for September as compared with August (Fig. 4). Although part of this decline is probably seasonal in character, it is significant in the light of the recent ad-



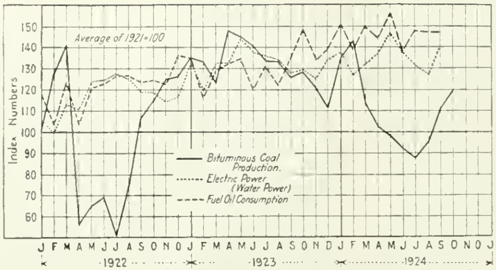
Sources, Iron Age; American Iron and Steel Institute. All curves corrected for seasonal variation.

FIG. 3 IRON AND STEEL PRODUCTION AND UNFILLED ORDERS



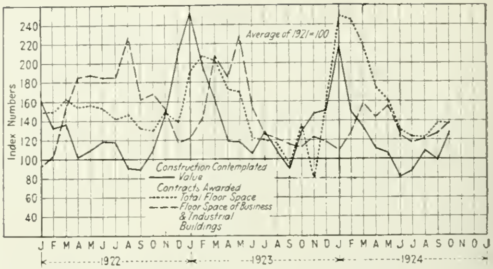
Sources, American Bureau of Metal Statistics; American Paper and Pulp Association; Bureau of Census; Department of Commerce. Cotton and wool curves corrected for seasonal variation.

FIG. 4 PRODUCTION IN FOUR IMPORTANT INDUSTRIES



Sources, Department of Interior; Bureau of Mines; United States Geological Survey. Bituminous coal and electric power curves corrected for seasonal variation.

FIG. 5 FUEL AND POWER PRODUCTION



Source, F. W. Dodge Company. Construction contemplated and total floor space curves corrected for seasonal variation.

FIG. 6 BUILDING CONSTRUCTION AND FLOOR SPACE IN CONTRACTS AWARDED

vance in copper prices. The development of foreign demand has provided the necessary stimulus to domestic buyers, and prices on November 11 are almost 6 per cent higher than a month ago, with the market strong and prices still firm or rising.

Paper. Production of paper declined slightly in September. Although conditions are improving and stocks of paper show no tendency to increase, the market is not strong.

Cotton. The October consumption of cotton by textile mills increased sharply, and was up 13 per cent even after eliminating seasonal variation. The outlook for the mills is more favorable. After a short period of irregularity, cotton textiles will probably show increasing firmness, with some advances.

Wool. The quantity of wool to be consumed in September increased far more than usual for the season, and the adjusted index rose above 100 per cent of the 1921 monthly average for the first time since March. The outlook is for greater activity in woolens and a continued rising trend in prices.

Fuel and Power

Bituminous Coal. The production of coal continued sharply upward during October, the gain being about 8 per cent greater than usual for the season (Fig. 5).

Fuel Oil. The consumption of fuel oil held steady during September, continuing the high level of July and August.

Hydroelectric Power. September showed a sharp recovery in the output of hydroelectric power plants. As this is contrary to the usual trend in that month, the adjusted index registered a large gain.

Conclusion. While unseasonable weather has held the coal market back, it is only a matter of time before higher fuel prices will come. Coal output will probably continue upward and gain another 15 per cent before it is checked. Fuel oil prices are due to rise as crude oil production is checked and crude prices are advanced.

Building Activity in October

Floor Space in Contracts Awarded. Building activity as measured by floor space in contracts awarded showed a further slight increase in October (Fig. 6). But as this was less than is usual for October, the adjusted index registered a slight net decrease. It is now 3 months since the volume of building ceased to decline and turned upward, and the increase in the index in that time has been only 9 per cent. This confirms our forecast that at best nothing more than a very moderate increase in building is to be expected.

Contemplated Construction. The seasonally corrected index of contemplated construction showed a decided increase over September, but is still considerably below the level for last year. The greatest increase was in the southwestern states and was largely due to public utility building. The northeastern, central, and far western states all report lower values for building permits than last year.

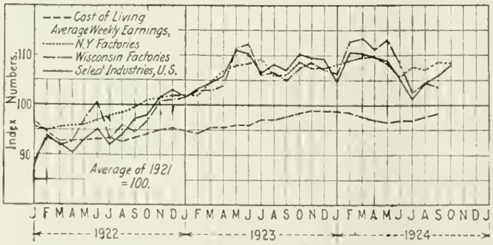
Conclusion. All indications point to the confirmation of former forecasts, that although building might increase slightly, nothing in the nature of a boom is to be anticipated. In fact, an increase in building costs is likely to curtail even the present upward movement.

Wage and Employment Situation

Earnings and Employment Gain

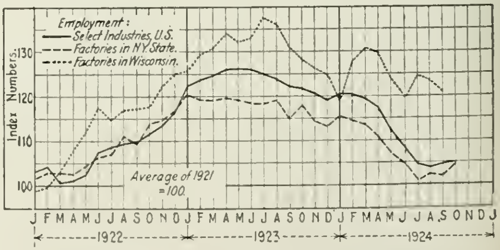
Earnings and Cost of Living

Selected Industries in the United States. (Fig. 7). Per capita earnings increased 2 per cent in October. The index is now 108. In October, wage rate increases were reported by 38 establish-



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin; National Industrial Conference Board. New York and Wisconsin curves corrected for seasonal variation.

FIG. 7 WAGES AND COST OF LIVING



Sources, U. S. Bureau of Labor Statistics; N. Y. State Dep't of Labor; Industrial Commission of Wisconsin. All curves corrected for seasonal variation.

FIG. 8 TREND OF EMPLOYMENT

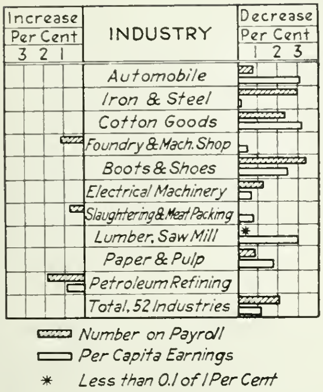


FIG. 9 TREND OF EMPLOYMENT AND EARNINGS, SEPTEMBER 1924

ments, and decreases were reported by 59 establishments.

New York State. The seasonally adjusted index was approximately the same in October as in September. A 1.8 per cent decrease in actual earnings was almost balanced by the normal decline of this period.

Wisconsin. The latest figures are for September. In that month the seasonally corrected index declined about 1 per cent to 103.5. Before correction the index showed a gain over the previous month.

Other States. Actual average weekly earnings advanced 2.3 per cent during October in Pennsylvania. They declined 0.8 per cent during the same period in New Jersey. In both states there were pronounced improvements in the textile industry, both in wages paid and in employment.

Cost of Living. The latest index out on October 15 is 98.2. This is an increase of 0.6 per cent.

Conclusion. On the whole, October reports show higher per capita earnings for factory employees. Earnings advanced in the United States as a whole. The decrease in New York was too small to be of much significance.

The Employment Trend

United States. (Fig. 8). The index of employment in manufacturing industries increased from 104.6 to 105 in October. This is after adjustment for normal monthly variation. Without this adjustment, employment showed an increase of 1.7 per cent.

New York State. The seasonally adjusted index of employment in this state increased slightly over 2 per cent in October. It now stands at 104.7. There were important gains in iron and steel, and continued improvement in the textile mills. The increase of factory employment in New York City alone was exceeded by that in the state as a whole.

Wisconsin. The latest figures are for September. Then the seasonally adjusted index showed a drop from 123.7 to 120.9.

Other States in October. The number of workers in manufacturing establishments of Pennsylvania increased 2.7 per cent. A similar increase of 1 per cent occurred in New Jersey. In both states the greatest improvement was in the textile industries.

Conclusion. All of the October reports show gains in employment. The index for the country as a whole is 5 per cent above its average during 1921. but 15 per cent below October 1923.

Employment and Earnings in Ten Selected Industries

Employment. There were advances in 7 of the 10 industries analyzed in September (Fig. 9). The increase for boots and shoes, 3.4 per cent, was the largest. Petroleum refining led the decreases with a 1.9 per cent drop. The average increase in employment for the total of 52 industries was 2.1 per cent.

Earnings. All of the 10 selected industries but petroleum refining showed increased per capita earnings. In the latter the drop was less than 1 per cent. The greatest advance was in cotton goods manufacturing, 3.2 per cent. For all 52 industries there was an average increase of 1.2 per cent.

Immigration and Emigration

Date	Immigrants	Emigrants	Net Gain
August 1924 .	23,290	8,633	14,657
July 1924	11,661	8,493	3,168
August 1923 .	88,286	6,489	81,797

Trend of Trade and Finance

Trade Conditions Unchanged: Prices Resume Rise

Bank Debits and Postal Receipts

Bank Debits. The weekly average of checks drawn in October was over 10 billion dollars against 9.7 billion dollars in September, but the adjusted index continued its downward trend (Fig. 10).

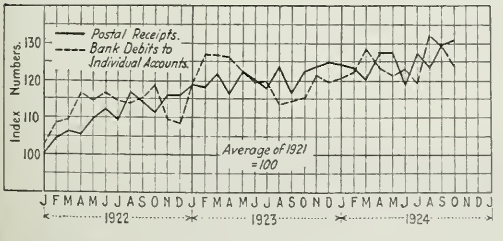
Postal Receipts. Receipts at 50 selected post offices showed only a slight gain above the usual seasonal increase. The adjusted index for October is 131.

Conclusion. The upward trend of the volume of business as distinguished from industrial output was checked in October. In view of the fact that the price averages advanced during that month, it is apparent that the physical volume of trade was materially reduced. The volume of wholesale and retail trade in October was just about normal.

Retail Trade

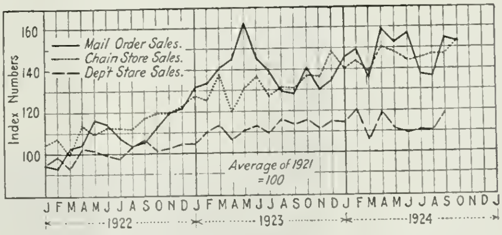
Mail Order Sales. The outstanding fact in retail trade data for October was the failure of mail order sales to come up to the usual seasonal gain for that month (Fig. 11). There was a large increase in sales and they were above those of last year, but the adjusted index was only 152.8 against 154.9 in September.

Chain Store Sales. The sales of four leading 5-and-10-cent chains gained more than usual in October and the adjusted index was up from 147.7 in September to 153.6 in October.



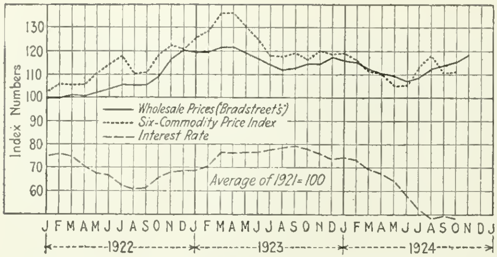
Sources, Federal Reserve Board; Post Office Department. Both curves corrected for seasonal variation.

FIG. 10 BANK DEBITS AND POSTAL RECEIPTS



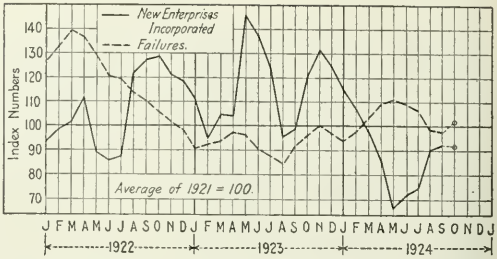
Sources, Commercial and Financial Chronicle; Federal Reserve Board. Data cover 2 mail order houses, 4 chain stores, and 306 department stores. All corrected for seasonal variation.

FIG. 11 SALES OF MAIL ORDER, CHAIN AND DEPARTMENT STORES



Sources, Commercial and Financial Chronicle; Bradstreets. Interest rate is the monthly average, corrected for seasonal variation.

FIG. 12 WHOLESALE PRICES AND INTEREST RATE



Sources, Dun's Review; New York Journal of Commerce. Both curves plotted as a 3 months' moving average, centered and corrected for seasonal variation.

FIG. 13 NEW ENTERPRISES AND BUSINESS FAILURES

Department Store Sales. The Federal Reserve Board index of department store sales showed the common trend in September, registering a gain of 8.2 per cent, after allowing for seasonal variation.

Conclusion. The late fall season has undoubtedly handicapped retail trade. Following an unseasonable spring, this is a serious blow. While retail trade will continue to show normal growth during the next 5 or 6 months, no unusual expansion is in sight.

Prices and Interest Rates

Prices. Bradstreet's index of wholesale commodity prices advanced 2.7 per cent in November (Fig. 12). This is a steady gain of 9 per cent since July 1.

The 6-commodity index prepared by the Bureau also advanced slightly in October, but was below the July and August levels, indicating current irregularity and hesitation in business values.

Interest Rates. The Bureau's October average of the rate on prime commercial paper in New York was 3.19 per cent. This indicates a slightly easier trend than existed in September.

Conclusion. Further moderate gains in the general price level are probable in the near future. Money rates bid fair to continue low during the balance of the year, but will probably increase after that.

New Enterprises and Failures

Failures. The number of business failures increased in October, bringing the seasonally adjusted index up to 102 per cent. The trend of the three months' moving average, Fig. 13, is temporarily up, but it is believed that the general trend of failures may still be downward.

New Enterprises. The volume of new business enterprises increased in October but, seasonally adjusted, declined to an index of 92. The trend of the three months' moving average is still up.

Conclusion. The foregoing facts show a halt in the improvement in business sentiment, but we consider this barometer, Fig. 13, as not unfavorable.

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VOLUME VIII DECEMBER, 1924 NUMBER 6

Management in Power Plant Building

The Pittsburgh Plate Glass Company Power House at Kokomo

By FRANK S. CLARK

Mechanical Engineer, Stone and Webster, Inc.

POWER for industrial purposes is generally one of the minor items of the cost of production, and for this reason very often is not given the consideration it should have. While the amount of the savings to be obtained from a proper selection of the source of power may be relatively small, expressed as a percentage of the cost of power it may be great. Therefore, careful study should be given to the subject, in order that the most economical means may be chosen.

In industries requiring power alone and no steam for processing or other uses, it may prove to be more economical to purchase power from the local central station company and install a boiler plant sufficient only for heating the plant. In other cases, where there is a demand for steam for use in the plant, it may prove more economical to generate the power and use bled or exhaust steam for the various manufacturing processes in the factory.

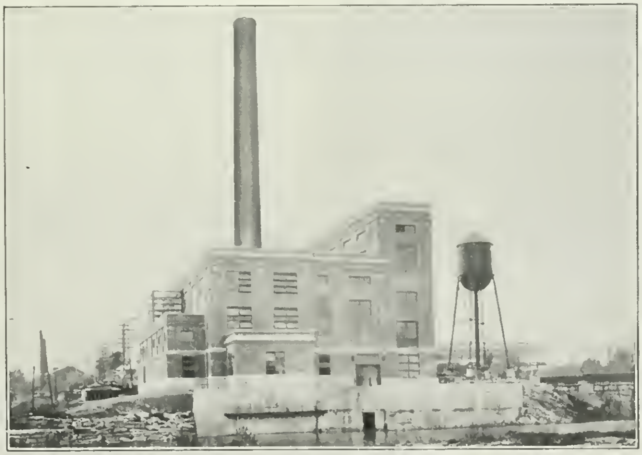

Fig. 1 The Pittsburgh Plate Glass Company Power House at Kokomo

The greatest loss in a steam power station is in the steam exhausted from the generating units. Where this steam can be used in the factory, the cost of producing power is greatly reduced. Factors other than those essential to the most economical production of power usually determine the location of an industrial plant, and therefore we very often find plants built at points remote from an adequate supply of water for condensing purposes. Artificial means of cooling condensing water must be used which impose on these factories a handicap of additional investment and higher operating costs for power production.

Index Number
658.26 Power plant and equipment

Where, after investigation, it proves more advantageous for an industrial plant to obtain the power required from its own station, the type and design of this station become of prime importance. These are determined principally by the size and character of the load, the load factor, fuel available, water for condensing purposes, and any special utilization of steam for heating or process work. If the latter requirements exist they will probably indicate the use of bleeder type turbines from which the necessary amounts of steam can be extracted after they have performed some work in the turbines.

The following is a description of the power station at the Kokomo plant of the Pittsburgh Plate Glass Company, and the factors influencing the design and

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[1] Illustrations courtesy of Stone and Webster, Inc.

the choice of various pieces of equipment. An exterior view of this plant is shown in Fig. 1.

The plant is one in which the principal load is from machines requiring 500 to 600 hp. each, which run intermittently for periods of one to two hours. There is no marked regularity in the manner in which the machines are run or in the number that may be running. There is also a large, sudden change in power demand when a machine is shut down or started up. The maximum demand amounts to about 7500 kw. and at times the plant runs on a 24-hr. basis. There is, therefore, a large amount of power required at a good load factor under normal operation.

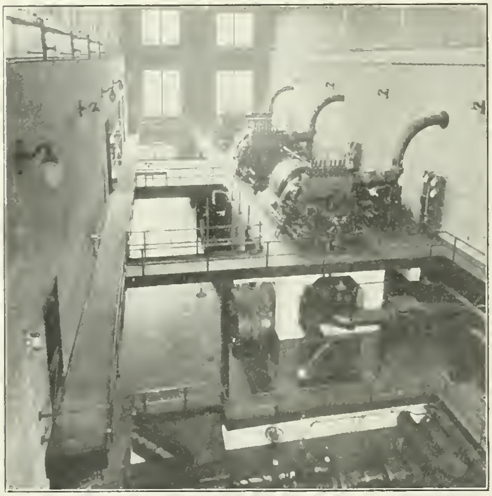

Fig. 2 Interior View of Power House Showing Steam Turbines, Condensers, and Auxiliary Equipment

Purchased power was out of the question, as the plant's requirements were greater than the capacity of the local central station and the power could be produced at a lesser cost.

There were no special requirements for steam in the manufacturing operations, and, as all the power was used in the form of electricity, more than the usual latitude was permitted in choosing the location of the station. A small stream ran through the property about a quarter of a mile from the main buildings, giving sufficient condensing water for most of the year without artificial cooling. The station was, therefore, located on this stream.

Turbines and Generators

As has been stated, the maximum load is about 7500 kw. The generating equipment installed consists of three 4000-kw. turbo-generators, as shown in Fig. 2, one unit being a spare. This arrangement insures reliability and flexibility of operation which are essential to a plant of this character.

The three turbo-generators are mounted on individual concrete supports, the tops of which are connected by operating galleries. Directly below each turbo-generator a surface condenser is installed between the concrete supporting columns. Adjacent to each condenser are located its circulating water and condensate removal pumps. This compact arrangement of equipment makes possible the large light wells shown to the left of the turbine platforms. All heavy pieces of equipment are handled by the overhead crane, which travels on the rails visible along the upper part of the walls in the picture.

To generate the steam for these units, six 665-hp. boilers are installed. A photograph of these is shown in Fig. 3. The steam produced is recorded by individual boiler meters, thereby giving a continuous record of the performance of each boiler, and making it possible to operate the plant at maximum efficiency.

Boiler Operation

As the plant is located in the Middle West, it is remote from the high-grade coals of West Virginia and Pennsylvania, but close to a high-volatile bituminous Indiana field. The fuel cost, therefore, is not excessive, and the reasonable steam pressure of 225 lb. per square inch was adopted. The steam is superheated 125 deg., making the total temperature 522 deg. There are 21 banks of tubes in each boiler, each bank containing 14 tubes. Each tube is 20 ft. long. No economizers are used. This equipment and operating system insure a reasonable over-all economy for the station at a moderate investment cost. No exceptional skill and training are necessary to run the plant efficiently.

Forced draft underfeed stokers are installed under

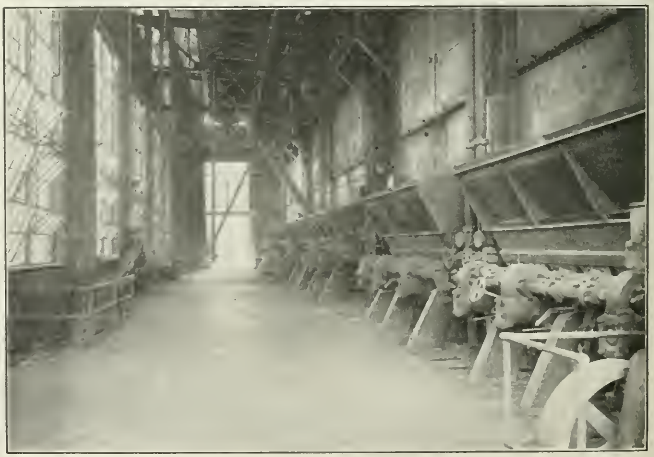

Fig. 3 Boiler-Room, Showing Coal-Weighing Larry and Stokers

the boilers. This type was selected because it could be made to burn the coal satisfactorily and would respond readily to sudden fluctuations of load.

Coal is received in cars, and elevating and conveying machinery are used to get it from the cars into the bunkers over the boilers. A concrete hopper is located under the track at one end of the station. From this the coal passes through a crusher to reduce it to a size suitable for the stokers. From the crusher it is carried by a bucket elevator to the top of the boiler-room and distributed to the bunkers by a belt conveyor, Fig. 4. The capacity of the coal-handling equipment is 60 tons per hr.

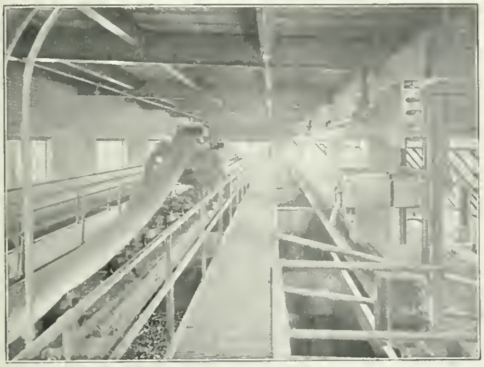

FIG. 4 BELT CONVEYOR DELIVERING COAL TO BUNKERS

The bunkers are of steel plate, lined with concrete. They are located over the boiler aisle and extend the length of the boiler-room. From the bunkers, the coal is drawn into an electric traveling weighing larry which distributes it to the hoppers of the stokers, as shown in Fig. 3. By means of the larry, an exact record is kept of the coal used in the station.

Ash-Handling Equipment

The mechanism for handling ashes is illustrated in Fig. 5. Discharged from the ash plates of the stokers, ashes drop into hoppers beneath the boilers. Motor trucks are run under these hoppers, the outlet gates are opened by means of the chain-operated wheels, and the contents fall into the trucks to be taken out to the dump.

At the top of the picture the forced draft duct is shown with its connections to the boilers. Air under pressure is forced through these ducts into compartments below the stokers. The picture also shows part of the steel framing which carries the boilers.

A single radial brick chimney located at one end of the station serves all 6 boilers. This chimney is 12 ft. in diameter and 230 ft. high. It is connected to the boiler uptakes by a steel plate flue.

Each of the 4000-kw. turbo-generators is provided with a 9000-sq. ft. surface condenser. The water-box ends of these condensers are shown in Fig. 6. In the foreground a standard-gage railway track utilizes the space which must be provided for withdrawing condenser tubes. The track permits equipment to be easily moved into and out of the building, this equipment being handled directly by the power house crane, which is located close to the roof of the turbine room, and runs on the overhead tracks shown in Fig. 2.

There is sufficient water in the stream for condensing purposes during most of the year. A spray pond is provided for cooling the water during the times when there is a deficiency in the stream flow. About half the water for the condensers is pumped through the spray heads and cooled. This water flows back into the stream above the station and then into the station intake well for use over again.

Switchboard Layout

The main switchboard consists of a 10-panel vertical slate board, with remote-control solenoid-operated oil circuit breakers mounted in concrete cells. The auxiliary switchboard is a 13-panel vertical slate board with hand-operated oil circuit breakers, mounted on pipe framework just back of the panels. The main board has three feeder panels, each controlling two outgoing circuits, a voltage regulator panel, a clock panel, two exciter panels, and three generator panels, each controlling one 4000-kw. turbo-generator. On the swinging bracket the synchroscope and bus instruments are mounted.

There is a single three-phase main bus installed in a concrete structure integral with the circuit breaker cells. The auxiliary bus is open and is mounted on a pipe framework at the rear of the auxiliary switchboard. It is divided into two sections, one of which controls the station auxiliaries, while the other is used for factory light and power, including the water supply pumps which are installed in the power house. Fig. 7 is a view of the switchboard.

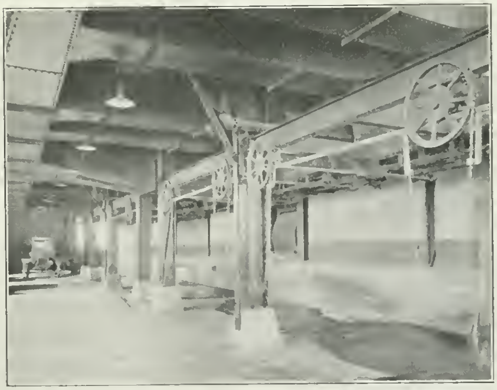

FIG. 5 ASH-HANDLING EQUIPMENT UNDER BOILERS

Transmission Lines

Feeder cables leave the electric bay overhead and are carried to the factory substations on a steel tower transmission line. The factory power load is carried on three main circuits, each of which consists of two 350,000 cir.-mil bare cables per phase. In addition, a 2300-volt lighting circuit and a miscellaneous power circuit are carried upon the tower.

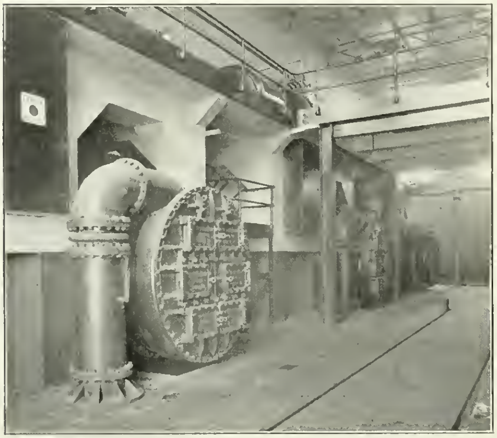

FIG. 6 SURFACE CONDENSERS BELOW STEAM TURBINES

High-voltage current is much more economically generated and transmitted than low-voltage because the generating equipment is smaller and the line loss is less. As the plant is extensive and consequently the power cables run considerable distances, it is cheaper to make and distribute power at 2300 volts and step it down to 220 in transformers at points of use, than it is to install and operate 220-volt generators and a 220-volt transmission line. Moreover, the modern development of safety devices and measures makes a 2300-volt outfit no more dangerous to life and property than a 220-volt system.

Auxiliary Equipment

The larger auxiliaries are equipped with 2300-volt motors, while the smaller motors operate at 220 volts. A bank of three 50-kw. transformers supplies the 220-volt motors and the station lighting system, which is three wire. Double throw switches are provided on the main switchboard so that the lighting circuits can be operated from the station transformer, or from the exciters in an emergency.

Protection against damage caused by trouble originating in the generator windings is provided by differential relays which are operated from current transformers connected within the delta of each generator. Temperature indicators are installed in each generator so that any undue heating can be detected before injury results to the windings and perhaps causes a short circuit.

An interesting management problem, as well as one requiring engineering judgment, was solved in the methods selected for operating the equipment to maintain a heat balance and therefore save money. Heat balance is hand-controlled and is obtained by operating some of the main auxiliaries with motor drive and others with turbine drive. In order to make this balance more controllable at all times, two of the circulating pumps and one of the exciters are equipped with combination drives, motor and steam-turbine.

The proportion of steam-driven to motor-driven auxiliaries running at any one time is varied in accordance with the load. This method maintains a proper feed-water temperature without waste of steam and expenditure of an excessive amount of electric power for auxiliaries when the load on the plant is a maximum.

Daylight in the Power Plant

The power plant described in this article, being of present-day construction, has had the benefit of up-to-date developments in design. In former days the lighting question received little attention in such plants. Inspection of the photographs, however, shows that at no point in this plant has the advantage of daylight been overlooked. The location of the condensers and pumping equipment on the ground floor, with turbines mounted above them and reached by galleries, allows light to penetrate in sufficient quantity to illuminate every part of the equipment. The boiler-room has ample window area and excellent light. Even the room where the ash-handling system is located is supplied with abundant natural light. The many windows along the coal-conveyor run likewise do away with the need of artificial illumination during daylight hours.

Good light, good ventilation, and a general condition of cleanliness save many dollars in the annual operating bills of a station like this and are well worth the little extra cost involved in bringing them about.

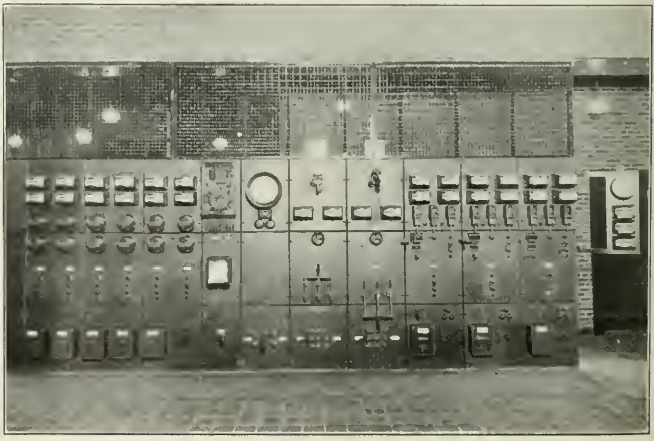

FIG. 7 MAIN SWITCHBOARD FOR POWER CIRCUITS

Forecasting the Underlying Cycles

Industrial Budget Methods—III

By JOSEPH H. BARBER

Staff Assistant to the President, Walworth Manufacturing Company

THE task of budget[1] forecasting is to show the administrator the economic materials he will find ready at hand for shaping his industry's future. The story must be translated into the industry's usual language, and predictions must be committed to familiar quantity terms in time for influencing executive decision.

Moreover, forecasting must justify itself not only by its clear perspective of the general ebb and flow of shifting fortunes, but more positively by its definite perception of the many flank movements of business. This article may underemphasize the much discussed *general* business cycle; it will not fail to stress the characteristics of cycle flank movements.

Prominent in the field of research to reveal these specific flank movements of business is the Harvard Committee on Economic Research. Their philosophy of approach to the problem contrasts with that of those who would construct some single index of "general business". Far from casting aspersions at the valuable contributions of others, however, we would merely state that the Harvard philosophy of approach has served to orient us and that we have been able to utilize their tested methods in our local fields of research.[2]

Instead of the one master index, they have developed many separate indexes—interrelated, to be sure, yet each professing to exhibit the characteristics of only a single phase of industrial or business activity. Fig. 22 shows their three fundamental indexes, concerning which we quote:[3]

> It will be seen that logical and important relationships exist in the movements of the three curves recorded on this chart. First of all it is clear that there is an interval of several months between the movements of each of the three curves. It is further evident that the turning point, whether upward or downward, always comes in the same order.

Internal Cycles and Their Relations

Now, this idea of picking business apart, rather than treating it as one grand whole, matched our growing impression of what must be done to insure any effective forecasting for our budget. The form of budget which serves us well is shown in Table 7, and its operation was explained in the fourth article of the former series.[4]

Index Number
658.14 Financial control
338.97 Business cycles

As the forecasting aid to our budget, we now tabulate and chart, for each column and each item, data which predicts the consequent internal effect of external economic causes. For any item, the related forecasting barometer in effect samples, for that unit and for that territory, the relevant one of the several broadly representative economic indexes to be discussed here.

With a natural curiosity, we watch our budget operate month by month, and we have learned that the changing trends of all items or of all columns by no means run in parallel, nor do they react in concert. Within our business there is not one cycle. Quite the contrary, there are many. Still, they are not unrelated cycles, for each is directly the consequence of some internal condition and the associated reaction from some external condition. This article passes on some of our findings as we attempted to explain these interrelations and their various effects.

The Subsidiary Cycles of General Business

If we resort again to the analogy of the "Typical" and the "Great" Corporation of article 1 of this series,[5] it will be obvious that we must, in all consistency, assume that for "general" business, too, there is not one cycle, but many. When we look at a single index purporting to reflect "general business" in its ups and downs we really see either: (1) just one aspect of some business or businesses which may be broadly representative of many; or (2) only the net effect of many ups and downs of various cycles, a sufficient number of which at times dominate the average so that it, too, shows a cycle movement.

With all due respect for "general purpose" cycle indexes of the second type there is a great tendency for an administrator to burden some such "general business" index with the responsibility of indicating the trend of *all* the items of his budget. Yet no general price index satisfies him in the analysis of his costs. The modern executive demands close watch upon

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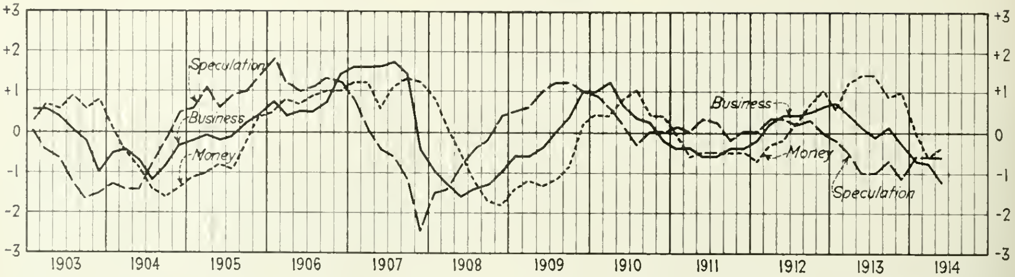
[1] See MANAGEMENT AND ADMINISTRATION for October 1924, p. 371; and November 1924, p. 479.

[2] Article II, MANAGEMENT AND ADMINISTRATION, November 1924, p. 479, recognized the influence of the Harvard conception of cycle analysis; defined some of their methods; and gave reference to others.

[3] "The Harvard Index of General Business Conditions—Its Interpretation" (1923)—Harvard University Committee on Economic Research, Cambridge, Massachusetts.

[4] See MANAGEMENT AND ADMINISTRATION, "The Monthly Financial Budget" (Two Parts), September 1923, p. 313; and October 1923, p. 453.

[5] MANAGEMENT AND ADMINISTRATION, October 1924, p. 371.



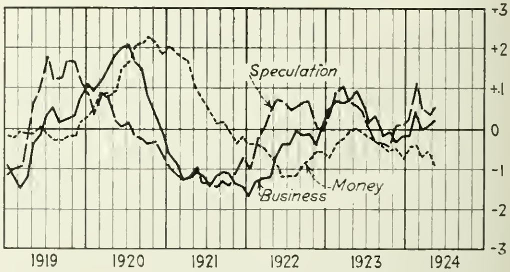


FIG. 22 HARVARD INDEX OF BUSINESS CONDITIONS

all the analytical costs that govern his net final cost. Why, then, does he not insist upon an understanding of the elementary economic cycles that cause the net average cycle so directly related to those costs?

Contrasting the Separate Cycles

Our purposes are best served, therefore, not by obscuring, but by revealing and contrasting the separate cycles that have relevancy in forecasting for an industrial budget. To paint our picture of cycles of business against a familiar background we shall imagine a budget, similar to that of Table 7, set up for the Great Corporation—buying, selling, intersubsidiary-corporation transfers, and the cash transactions or exchange of purchasing power.

The budget will be set up for each territorial unit, with a summary line for totals of all units. This total line is really the grand summary of all the Great Corporation's trade. If, in any month, there is a discrepancy in cash, then the Great Corporation—just as any typical corporation—must get temporary finances or credit from the commercial bank for its needs.

TABLE 7. FINAL COMPILATION OF COMPLETE BUDGET FOR BUSINESS OPERATION[1]

Walworth Manufacturing Company and Subsidiaries[3]
(Even Dollars)

For Month of. . . . . . .1924.

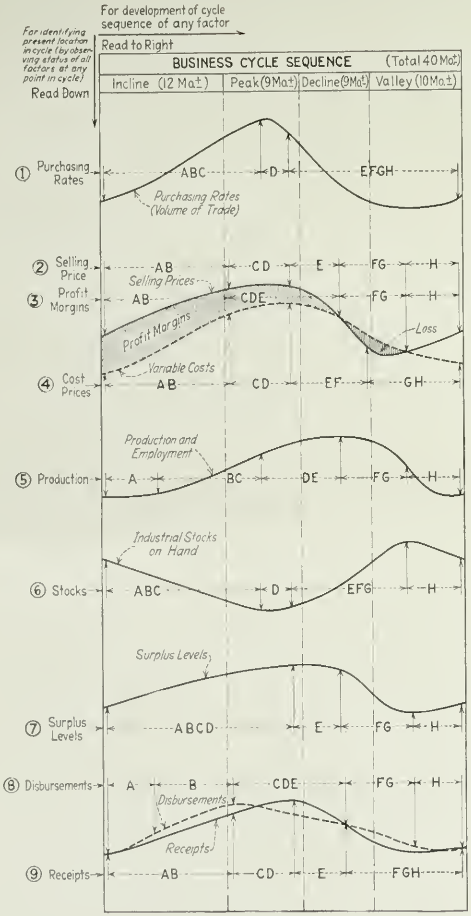
COLUMN LETTER ITEM	(A) BILLINGS	(B) PURCHASES	(C) PAY-ROLL	(D) INTER-CO. BILLING	(E) INTER-CO. PURCHASES	(F) COMBINED BILLING	(G) COMBINED PURCHASES	(H) CASH RECEIPTS	(I) CASH DISBURSEMENTS
(1) General office	......	31,000	43,000	....	300	....	74,300	146,000	1,370,000
(2) Eastern division	195,000	10,000	9,000	....	170,000	195,000	189,000	210,000	....
(3) Boston works	13,000	260,000	250,000	500,000	78,000	513,000	588,000	....	....
(4) Western division	560,000	11,000	12,000	......	520,000	560,000	543,000	880,000	875,000
(5) Kewanee works	75,000	440,000	380,000	910,000	53,000	985,000	873,000	....	....
(6) Boston branch	240,000	167,000	18,000	9,000	120,000	249,000	305,000	240,000	....
(7) New York	250,000	100,000	22,000	200	150,000	250,200	272,000	240,000	65,000
(8) Chicago	210,000	88,000	19,000	5,000	98,000	215,000	205,000	196,000	46,000
(9) Seattle	135,000	132,000	12,000	3,300	13,000	138,300	157,000	158,000	97,000
(10) Philadelphia	195,000	100,000	11,000	500	67,000	195,500	178,000	188,000	70,000
(11) Walworth Oregon Co.	165,000	134,000	11,000	2,400	11,000	167,400	156,000	165,000	143,000
(12) Buffalo branch	120,000	116,000	10,000	2,000	9,000	122,000	135,000	140,000	85,000
(13) Total branches	1,315,000	837,000	103,000	22,400	468,000	1,337,400	1,408,000	1,327,000	506,000
(14) Walworth International Co	195,000	48,000	11,000		150,000	195,000	209,000	180,000	155,000
(15) Walworth Ohio Co.	275,000	125,000	25,000	1,000	175,000	276,000	325,000	250,000	70,000
(16) Walworth Munz. Co.	175,000	140,000	10,000	2,500	10,000	177,500	160,000	190,000	75,000
(17) Total	2,803,000	1,902,000	843,000	1,435,900	1,624,300	4,238,900	4,369,300	3,183,000	3,051,000
(18) Total pay-roll	......	843,000							
(19) Inter-company	...	...						470,000	470,000
(20) Total	2,803,000	2,745,000						2,713,000	2,581,000
(21) Financial expense[2]	......	164,000							
(22) Total	2,803,000	2,909,000							
(23) Capital and other charges	......	....							
(24) Total	2,803,000	2,909,000							

[1] All the figures and their relations as shown are fictitious.

Financial Expense includes:
$96,000 for Special Funds.
2,500 for Interest on Notes Payable.
26,900 for Interest on Bonds (book charge only).
5,400 for New York Rental (book charge only).
10,800 for Insurance.
11,600 for Branch Extra Purchasing and Deferred Charges.
9,300 for Plumbing Catalog account.

$162,500 Total of Financial Expense.

[3] None of the figures on the budget indicate the effect of any proposed note transaction.



NOTES BY LETTERED SEQUENCES
(Cycle Numbers correspond to Cycle Numbers of Figure 23)

Cycle Numbers	A	B	C	D	E	F	G	H
1	ABC Forward ordering at low commodity costs induced by anticipated price increases			D Forward ordering ceases in fear of price drop	EFGH Hand to mouth buying against current needs only, with needs constantly at lower levels			
2	AB Sales prices steadily rising as effect of increasing purchasing power (See 8-AB below). Rate of increase slow at first if continued unemployment (See 4-GH) restricts purchasing power of wage-earners		CD Selling prices stable, because customers cannot pay out more than they get. Roughly, receipts and disbursements about balanced (See 7-CD below)		E Lack of buying power, more-than-normal stocks, and fear, with consequent producers competition, forces price decline	FG In spite of relatively increased purchasing power to buy more than hand to mouth, (See 8-FG below), lack of confidence leads to increase in "Savings," while competition rapidly liquidates selling prices to rock bottom.		H Restored confidence. Use of savings, (deferred use of relatively increased purchasing power (See 2FG) permits some rebound of sales prices toward normal.
3	AB Widest Profit Margins. Best opportunity to invest excess in low-cost, more-than-hand-to-mouth inventories, thus accumulating surplus (See 7-AB below). Profits also used for dividends, forward buying (See 1-ABC) plant expansion, etc		CDE If profits exceed dividends, plus any extra dividends, they should be funded (invested in bonds) or partially utilized to carry increased receivables, as stocks are shipped to customers			FG Loss. Cost prices do not decline as fast as selling prices. May not show at once as net loss on balance sheet. If above-normal production rates (See 5-FG) still permit thin distribution of overhead to increasing inventory. (See 6 EFG)		H Profit margin gradually restored by action of 2-H and 4-GH
4	AB Variable Costs (including wages and all other variable costs of producing goods, but excluding dividends, fixed charges and other portions of net profits), develop rising trend as demand of customers becomes an increasing demand for raw material. Then comes 1-ABC		CD Cost still rising, or at best, stabilizing, as forward contracts are being worked out		EF Raw materials costs drop nearly as fast as selling prices, but wage rates resist decline prior to actual or threatened unemployment		GH Labor wage (element of cost) declines but gradually, probably induced by a period of unemployment. Raw material prices still declining or stable, as early increased demand (See 2-H) is satisfied from existing stocks. Total variable costs stable or slightly declining	
5	A Production at low rates because inventories already high enough to care for immediate needs and more	BC Production not increased in parallel with trade which is liquidating inventories as well as sustaining production		DE High consumption rates induce heavy capacity production rates, which appear necessary to restore inventory to levels comparable with recent "record" consumption, or ordering, rates.		FG Following confirmed decline in consumption, production is curtailed, but not as soon, nor so sharply, as to match decline in consumption. Hence, excess production builds up stocks		H Sharp cuts in production and part-time employment to liquidate stocks.
6	ABC Stocks gradually liquidating due to shipments against a growing demand greater than current production rate			D Stocks reduced to minimum by peak demand before production increased to care for it	EFG Stocks gradually increasing despite some production curtailment, which, nevertheless, exceeds current demand and shipments falling faster than production.			H Stocks finally start down as drastic cuts in production restore excess of stock outgo over input to stock
7	ABCD Surplus (accumulated levels of "hoarding"- which may be increased by increasing total of accounts receivable, prepaid items, stocks not currently consumed, etc.) gradually builds up while profit margin is more-than-average, and greater than dividend rate				E Slightly declines as dividend payments, including "extras," must be paid partially out of surplus	FG Rapid decline due to actual loss, disbursements greater than income, (See 8-FG) plus added disbursement of regular dividends out of surplus, (if they are not passed)		H Probably dividends passed, to enable cash disbursements to balance cash receipts (See 8-H)
8	A "Disbursements" include dividends and all cash outflow. In this period after readjustments, accumulated profits are spent in increased buying for inventory at low cost prices.	B Increasing excess of disbursements over receipts (resulting from forward buying. See 1-ABC and made possible by bank loans) induces increasing prices (See 2-AB) optimism and more forward ordering.	CDE Continued reservations of profits into a surplus fund, without disbursing an equal value of purchasing power borrowed from the banks, or other sources, has the effect of not passing on to the consumer all the "purchasing power" he has passed to us in our "receipts" (See 9-CD), so that, later on, he cannot be in the market to buy an equal volume at equal prices. Therefore, with a gradually lessened purchasing power, he cannot buy more than an equal volume at lower prices, (unless there be inflation through expanded bank loans,- which will temporarily continue a margin of disbursements over receipts but will only defer for a few months the next stage of the cycle.)			FG Bank will not increase loans further due to uncertainty of full payment in usual 90 days. Therefore, disbursements become greater than receipts, partly to repay bank loans, but also, and largely, due to loss (See 3-FG), which in itself means costs (and disbursements) greater than selling prices and receipts.) Thus, more purchasing power is released to consumers than is at this time being received from them (See 2-FG). Hence, the relatively increased purchasing power referred to in 2-FG		H Disbursement of dividends probably out of surplus as it is gradually converted into cash. Outgo gradually balanced against income, completing "readjustment"
9	AB Receipts increasing because of increased consumption, and increased forward buying, (See 1-ABC) all at increasing sales prices (See 2-AB).		CD Increasing receipts from customers (who use bank loans to pay for forward purchases, as shipments complete their contracts.) Thus, these receipts overtake disbursements, but the excess cash soon becomes tied up in receivables and extended credit. Bank loans, as well as part of surplus, are then utilized to carry expanded current assets (See 7-ABCD)		E Because of decreased disbursements (See 8-CDE) accounts and bank loans become frozen because of restricted circulating purchasing power. Part of purchasing power is being "hoarded" in surplus (See 8-CDE).	FGH Purchasing rates (See 1-EFGH), declining and stabilizing, would cause further decline in receipts, but sales prices stabilize and then increase (See 2-H) and frozen accounts are gradually collected, so that receipts stabilize and finally balance with disbursements, (See 8-H). Upon regaining this balanced condition, and because of the optimism of 4-GH and 8-H, the stage is set for the beginning of another cycle		

FIG. 23 ANALYSIS OF BUSINESS CYCLE SEQUENCES FROM THE STANDPOINT OF BUDGET REQUIREMENTS

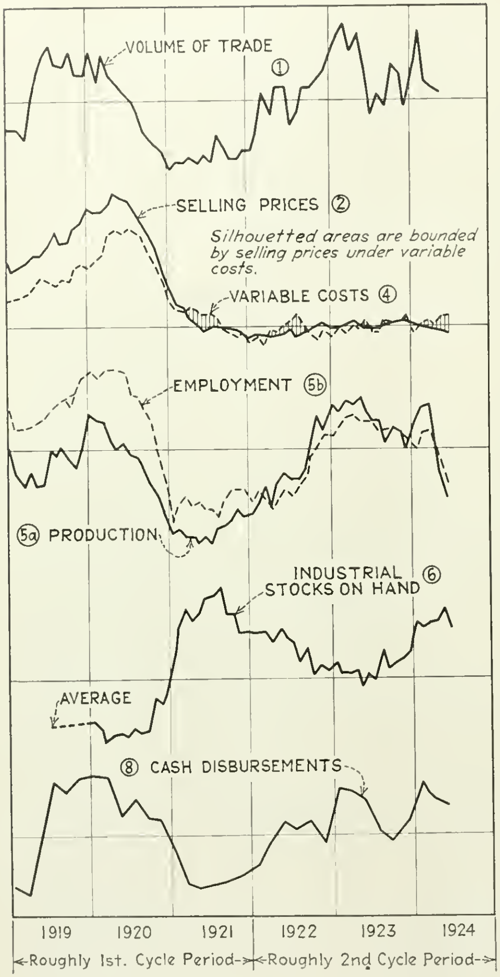


FIG. 24 ACTUAL CYCLES TO SUBSTANTIATE FIG. 23 DIAGRAMS

With this background we shall review the broadly representative cycles that affect the line 17 totals of the Great Corporation's budget. The indexes we shall study will all be broadly representative of the United States industrial conditions as a whole. They are all prepared by notable authorities to whom full credit is given. Our only purpose is to show the interested administrator how close is their relation to his budget problems. As we do, so may he construct similar cycle indexes of the several phases of business in the many territories, and in the combination of territories, sustaining his industry. It is to be emphasized that, commensurate with the value derived, the cost is moderate; for the business statistician, by territories—just as we have here for the total—utilizes the finished product of authorities as his raw materials.

TABLE 8. EXPLANATION OF SOURCES AND METHODS

Cycle 1. Carl Snyder's volume of trade index, "A New Barometer of Industry." MANAGEMENT AND ADMINISTRATION, December 1923, p. 736. An average of seasonally corrected trade indexes in per cent of their respective normals.

Cycle 2. Federal reserve wholesale price index of consumers' goods, *Survey of Current Business.* No seasonal correction, but shown in per cent of base, shifted by short method to base 1921-1923 average month = 100.

Cycle 4. This index is based upon:

(a) Dr. W. A. Berridge's money incomes index. (J. Walter Thompson Company's prize essay.) Seasonally corrected and shown in percentage of base, shifted by short method to base 1921-1923 average month = 100.

(b) Federal reserve index of basic production, *Federal Reserve Bulletin*, final, December 1922; and, recently, *Survey of Current Business.* An average of seasonally corrected production indexes shown in per cent of base, shifted by short method to base 1921-1923 average month = 100.

(c) Federal reserve wholesale price index of raw materials, *Survey of Current Business.* No seasonal correction, but shown in per cent of base, shifted by short method to base 1921-1923 average month = 100. (See further extended explanation below following the comments for Cycle 8.)

Cycle 5 (a). Standard Daily Trade Service index of industrial production, Third Quarter 1924, *Statistical Bulletin.* An average of seasonally corrected production indexes in per cent of their respective normals.

Cycle 5 (b). Harvard Economic Service (by Dr. W. A. Berridge) index of industrial employment (number employed). *Statistical Record*, 1923. No seasonal correction, but shown in per cent of base, shifted to base 1919-1922 average month = 100.

Admittedly, a slightly erroneous impression is gained when the money incomes index upon a fixed base is shown against the production index, which is corrected for secular trend. The inference drawn, however (that, relatively, in recent years, there has been greater production for a lesser expenditure), errs only in that efficiency in utilization of labor has improved to an even greater degree than graphically indicated.

Cycle 6. Department of Commerce index of total industrial stocks on hand, *Survey of Current Business.* An average of seasonally corrected indexes, each in per cent of base 1920 average month = 100. Average index here shown in per cent of base shifted by short method to 1919-1922 average month = 100.

Cycle 8. Federal reserve total debits to individual accounts in 141 comparable cities, including New York. Federal reserve annual reports and Department of Commerce News Releases. Seasonally corrected and shown in per cent of base 1919-1922 average month = 100. Smooth curve results from bi-monthly averaging.

Cycle 4 (Concluded). The variable costs index, numbered 4, assumes that Dr. Berridge's money incomes index is broadly representative of total United States industrial pay-roll cycles, and that the federal reserve basic production index fairly corresponds to the cycles of all industrial production. In fact, the basic production index (upon a base which could be shifted, as was required) checks well against other authoritative indexes claiming to gage the variations of all industrial production. Necessarily, all the indexes utilized were shifted by the short method to a very recent base period, but, when thus expressed in common denominator terms, Money Paid was divided by Production Received, month by month, to secure a Labor Cost per Unit index. This resulting index of labor costs was then averaged (two-thirds–one-third weighting, respectively), with the federal reserve index of raw material prices, thereby deriving the variable costs index shown.

Initial presentation is by diagram and tabulated comment (Fig. 23 and accompanying notes). For simplicity, and despite our belief that the stock market is the melting pot for the refining, purging, and evaluating of business information, an index of cycles of speculation is not brought into the discussion at this point. The Fig. 23 diagrammatic indexes and their commentary notes and cross-references are confined as far as possible to only those cycles directly affecting budget items.

Object of Preliminary Presentation

This initial presentation is intended only to convey an idea of "what to watch for" in the light of rules deduced from past experience for depicting the "ideal" cycle. Of course, the ideal cycle of adjustment and readjustment is only a fancy. However, with such a diagram of what ought to happen in each of its several cycles and during its various stages, we approach an analysis of conditions in the post-war period with some hope of understanding them and of interpreting their significance.

So far as actual indexes are available to parallel the diagrammatic indexes of Fig. 23, they are brought together in Fig. 24. Well-known authorities have contributed each, but it is our presumption thus to associate them as a coherent group. In order to subordinate questions irrelevant to the main purport of the discussion, it is admitted that, for ease of presentation in this case also, scales were selected so as to makes all cycles appear approximately of like size. Our sources and methods for deriving the various cycle indexes are given in the explanation accompanying Table 8. These explanations pertain to sources, etc., for data of Fig. 24.

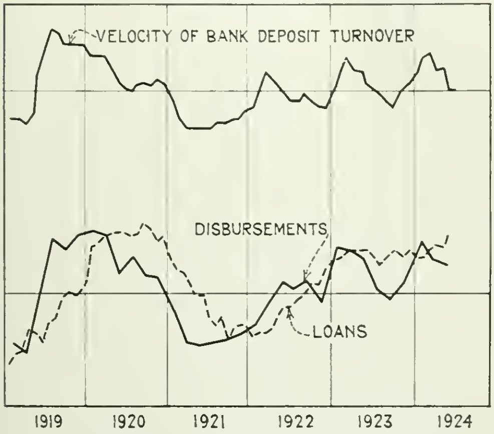


FIG. 25 CYCLES OF CASH RECEIPTS, CASH DISBURSEMENTS, AND BANK FINANCING

There are not available adequate general indexes to substantiate the trends shown in Fig. 23 for Cycles 7 and 9, nor to demonstrate the interrelations indicated between Cycles 8 and 9. Nevertheless, deduction from Fig. 25 will prove the theory by inference.

The proof relies mainly upon Carl Snyder's recently developed velocity index.[6] This index is of itself an excellent barometer of approaching trade changes. From his velocity index line in Fig. 25, note, first, that acceleration to above-normal velocities always precedes resort to bank loans[7] and the consequent rapid ascent of disbursements;[8] and observe, second and conversely, that, following the trade boom, sharp retardation to below-normal velocities heralds an approaching period of readjustment.

Using the 1919 to 1921 fluctuations of all these indexes to illustrate our reasoning, we see first that disbursements sharply rise ahead of loans. Obviously they should, for trade's early obligation is to finance increasing disbursements out of owned funds. This places a burden upon existing deposits. The consequent swift velocity acceleration to untenable levels finally forces resort to rapidly expanding loans and discounts, the only purpose of which apparently, is to finance inflated prices (for Cycle 1, Fig. 24, shows that the quantity volume of trade is already declining). Even at their peak, disbursements still exceed receipts, as implied by the continuing increase of loans out of parallel with deposits, which by this time are stabilized at their peak levels.

Following the peak of disbursements, and during their initial gradual recession, the delayed, yet inevitable, inflow of peak receipts will exceed current disbursements. At this time, the retarded-to-only-normal velocity of turnover argues that the excess of receipts is not re-entering trade—that is, that it is not turning over. For a while, it is just serving currently to finance, yet not to increase, already augmented surpluses reflected upon the accounts as inflated inventories and as expanded receivables.

In the final period of the cycle, the disbursements necessarily must be exceeding receipts again, because current losses preclude receipts equivalent to previous expenditure, and because trade must, and does, liquidate outstanding loans faster than it diminishes deposits. Clinching this deduction, a below-normal velocity argues that disbursements are not all involved in normal trade exchange wherein receipts and disbursements maintain equality.

It is felt that in the light of Fig. 23 and its accompanying notes, Figs. 24 and 25 should prove very illuminating as to post-war trends. At all times it is the exception to the rule that demands investigation and explanation, if possible. The 1919-1921 period is notably an exception to the rule only in the probably unprecedented extent, both in margin and in duration,

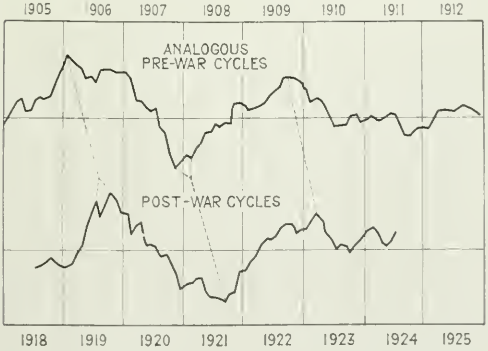


FIG. 26 DOW-JONES AVERAGES—INDUSTRIAL STOCKS

of the profit advantage between variable costs and selling prices. In the presence of such an inducement, enterprisers did not need the added inducement of driving the volume of trade to above-normal levels to secure thinner distribution of fixed charges.

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[6] "Turnover of Deposits a Measure of Business Activity," *Journal of the American Bankers' Association*, February 1924.

[7] Total loans, discounts, and investments for all reporting member banks, first day of each month. From federal reserve annual reports and their recent news releases. Not seasonally corrected but shown in per cent of base 1919-1922 average month = 100.

[8] Disbursements curve is the same as shown in Fig. 24.

In the recent three-year period from early 1922 to the present, off-hand there seem to be continually cropping up exceptions to some of the rules. Though the operation of the rules is, even so, still discernible, the apparent exceptions have caused a number of notable intermediate or secondary cycles within the long swing traceable as a developing cycle over the whole period.

In the spring of 1922, in the face of an accumulation of deferred requirements, quantity quickly assumed normal proportions when variable costs and selling prices finally became balanced. Then, with larger distribution of overhead over increasing volumes, probably to be sold at higher prices, there should have been prompt restoration of adequate net profits on the administrator's final balance sheet.

However, confidence in the middle of 1922 was shaken by a narrowing profit margin, predicting an oncoming discrepancy between variable costs and selling prices. The condition actually was unbalanced. These indexes would currently have shown so at the time. The labor cost element continued low. Consequent purchasing power was low, although employment had increased. On the other hand, while selling prices proved obstinate, raw material prices did not fail to respond to increased demand, and administrators waited.

By the end of 1922, variable costs had readjusted, stocks had been drawn down, and employment's purchasing power had extinguished personal debts carried over from the depression. Therefore, returning confidence perceived a potential more-than-normal demand, including forward buying that seemed to be expressing itself in a belated increase of selling prices.

But then there came again, in the early spring of 1922, that narrowing cost margin, that stubborn resistance of selling prices, and an assurance that peak volumes will not mix with price discrepancies! Moreover, sharply curtailed commitments and consequent declines in production rates already suggested that greater fixed overhead charges would shortly associate with increased variable costs upon the unit cost books. Net losses under such conditions would be inevitable and caution dispelled the previous optimism.

By the end of 1923 there were again certain accumulated requirements. The intermediate curtailment had been overdone in view of the general long-sweep trend throughout the period. Necessarily, and in spite of price discrepancies, contemplated projects and deferred policy executions were resumed with the passing of the inventory period. Records show that our end of 1923 outline for our 1924 budget predicted just such a short-lived, church-steeple peak as occurred in the first quarter of this year; but, on the other hand, we did not anticipate that selling prices would so far prove an exception to the rule that they not only would fail to rise, but would actually decline.

The inference from the latest postings of curves 3 and 4 in Fig. 24 is for a sluggish demand during the last half of the year. Preferably there should be further downward revision of variable costs. Already in June the raw materials prices had relatively stabilized sufficiently low, but the labor cost—partly affected by labor efficiency and partly by labor rates—had not been readjusted sufficiently to suggest any inducement for administrators to regain "confidence". Certainly, not yet is there restoration of the kind of "confidence" that existed in Fig. 24 between the cycle curves 2 and 4 during 1919.

Stocks on hand are now high, but liquidation should be swiftly accomplished if the present curtailed production is sufficiently prolonged. Moreover, if such curtailment, with consequent unemployment, leads to lower wage rates or to markedly improved efficiency, then foundations will be well laid in advance for a real, according-to-rule recovery in early 1925. The indexes will report to us this month-by-month progress.

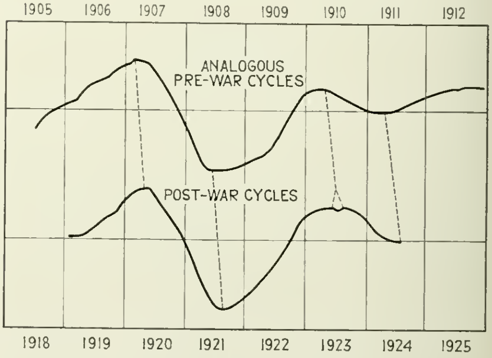

Fig. 27 Walworth Sales Cycles

A common weakness among business forecasters tempts them to seek for periods in the past which shall confirm their analysis of present conditions. Yet we all admit there is at least a little comfort in the fact that present theory or opinion is not without precedent. In Fig. 26, industrial stock price cycles illustrate the potential merit of such analogy, and they also claim prestige as indicators of improving or restored industrial "confidence," since the price of stock to a large extent is governed by the present, and yet more dominatingly by the future, "yield" conditions.

And, again, for the specific industry also, there is value in such analogy. It provides the sort of background or starting point for determining why the present case should be different. Fig. 27 shows the corresponding analogy from our billings index.[9]

(To be continued in the January 1925 issue)

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[9] Note that in Fig. 27 post-war cycles, our sales lag but slightly behind the corresponding pre-war turning points, as contrasted with the noticeably greater lag of post-war stock price cycles behind their pre-war precedents. (See Fig. 26). In contrast with our pre-war cycles of largely retail trade, our post-war cycle is dominated by jobber trade which reflects cycles early. Turning points in our post-war retail trade cycles only, as against our pre-war retail trade, would lag as do the post-war stock price cycles in Fig. 26.

Planning the Construction Program

Value of Specialized Knowledge in Industrial Building

By A. G. ANDERSON

Index Number

658.2 Industrial buildings

CONFRONTED with the need for enlarging a plant or perhaps building a new one, the industrial executive is frequently perplexed as to just how he should handle the task. The situation is not simplified any by the many tenders of professional and technical service which he inevitably receives. These come from architects and engineers practicing under general titles or as specialists, and all urge the merit of the service which they can render. Yet it is self-evident that many of these firms differ widely in the character of their personnel, extent of practice and experience, and in their methods of operation. Considering his need, it is the executive's task to select from among them the one firm which will prove most helpful. It is the purpose of this article to point out the factors involved in making such a decision.

It may be that the thrifty plant executive will consider the idea of utilizing his own staff in making plant extensions, but experience indicates that this practice is seldom advisable. It must be recognized that the building industry is a highly developed business, requiring the close co-ordination of many specialized groups, and the intelligent, experienced efforts of men trained in the business. Factory executives, draftsmen, purchasing agents, superintendents, foremen, and workmen invariably prove novices when handling unfamiliar tasks. The functions performed may be the same, it is true, but the experience called for and the technique involved are radically different. Even building laborers are semi-skilled, and the factory worker on a building job seldom proves more than 50 per cent efficient. Differences in accomplishments are equally noticeable among those higher in the organization. Because on unusual work of this kind it is difficult, if not impossible, to establish and maintain standards of performance or even to make cost comparisons, expense may mount to a high figure before becoming apparent. This inability to check costs extends to materials and administration as well as labor, for experience will be lacking in selecting and purchasing materials and in solving the multitude of problems which arise.

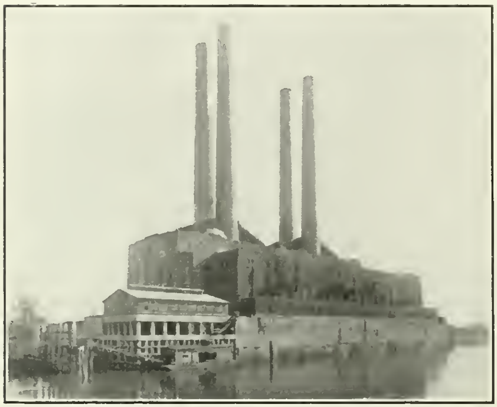
Every contractor realizes the great importance of careful preplanning, successful co-ordination of the various trades and phases of the work, and the skilled direction of the workmen. Lack of judgment and ability in these respects increases job costs enormously, and the industrial executive may well leave the task for those who are in the business. There is probably no industry where low labor costs are so dependent upon the skilled choosing and direction of workmen, or where costs may double or even triple without apparent reason.

Observation and experience also indicate that building programs handled in this way take much more time and attention from all concerned than anyone had any idea they would. They inevitably disrupt routine production, interfere with service to customers, and

Courtesy of Dwight P. Robinson and Company

FIG. 1 TANNERY BUILDING CONSTRUCTED FOR ARMOUR LEATHER COMPANY

take the time and thought of executives, with resulting confusion throughout the organization. Few large firms who maintain construction crews for repairs and maintenance attempt to handle major operations. They have found that the specialized talent required is found in particular organizations and that the use of this specialized service pays dividends on its cost.



Courtesy of McClellan and Junkersfeld, Inc.

FIG. 2 FIRST TWO UNITS OF CAHOKIA POWER PLANT, UNION ELECTRIC LIGHT AND POWER COMPANY

A certain manufacturing firm producing bottles and package goods decided to dispense with architectural and contracting service and to build its own new plant. The executive committee was to handle the task, aided by an engineer, a relative of the owners, who was depended upon to provide the technical assistance required and to handle actual building operations. The management contributed ideas regarding the production layout and working arrangements which the engineer endeavored to embody in working drawings. Conflicting ideas resulted in compromises, and sometimes good judgment and opinions based upon fact did not prevail over poor judgment and unsound ideas. The vision of these men did not extend far enough outside their own plant walls; excepting in a superficial way, the work was incidental and added to their regular duties; and no one individual was responsible for the resulting plan in its entirety. As a consequence the resulting layout was a patchwork of imperfect, uncorrelated ideas.

During this time the members of the executive committee were besieged by salesmen for all kinds of materials and equipment. A great deal of executive time was taken, as the inexperience of these men handicapped them in reaching decisions. The plans and specifications as finally completed called for a three-story and basement, reinforced concrete design building with solid brick enclosing curtain walls. Construction was begun, but was hindered constantly and made expensive by frequent changes in the plans. There was a distinct lack of co-ordination in carrying on the work of the different trades, and many delays occasioned by shortages of materials because of imperfect administration and faulty purchasing arrangements. Overhead and operating costs were greatly increased as a consequence.

After completion it became necessary to drill some 200 holes through 12 in. thick concrete floors, at great expense, to fit revised piping plans. The floors themselves had been designed and constructed to carry much heavier loads than necessary at an excess cost of nearly $7,000. The 9 in. thick brick curtain walls failed to keep out dampness and cold. Unnecessary story heights wasted space which had cost money and required heating. The heating system proved inadequate on account of unwise selection of boiler equipment. Many other deficiencies came to light. The building does not represent good factory design; it is inefficient as a production machine, and expensive to maintain. It cost entirely too much money to build.

An Ohio manufacturer who objected to the union labor used on all construction jobs in his locality, and desiring to save money also—the architect's and contractor's fees—decided to take advantage of a slack industrial period to build a new building, utilizing his own organization to do the work. A draftsman, who thought himself clever, with some novel ideas of building design "got them across" to those in charge. To the inexpert they looked good on paper, as they apparently saved a considerable amount of material and labor. One of these ideas was to build the enclosing walls of the building of brick one course (4 in.) in thickness, stiffened with horizontal reinforcing laid in the joints and with vertical hollow piers at intervals, which were to be filled with concrete. This proved to be very expensive construction, and the wall when completed let through dampness and cold which ruined

Courtesy of McClellan and Junkersfeld, Inc.

FIG. 3 880-HP. BOILER PLANT BUILT FOR FRANKLIN, BAKER COMPANY the plastering and wood wainscoting. The efforts of the amateur bricklayers and carpenters on this job would have been ludicrous had they not been so serious, financially. Ordinary labor cost for this work must have been doubled in spite of the lower scale of wages paid. It is not probable, however, that any check on the cost of this project was ever made.

The employment of an architect usually provides for the preparation of plans and specifications, the letting of contracts, and the supervision of construction. In this way much of the responsibility is delegated to qualified men. Strictly speaking, however, the design of factories has little relation to architecture. To handle the task requires a thorough knowledge of the production processes to be cared for, and an understanding of factory management and production control, including an appreciation of the reaction of the workers to the equipment and facilities provided. The human factor is the biggest single factor in production and must be considered accordingly. These subjects are foreign to the training of the typical architect. It is scarcely possible that he will look upon the task as that of fitting a housing scheme to a production machine—which he has also created or at least analyzed and checked carefully—so that it will function as a part of the machine itself. This is a decidedly prosaic, utilitarian, dollars-and-cents-balancing job, calling for a wide range of engineering and production talent and an understanding of the psychology and needs of labor. Architectural design will prove to be a very minor feature. If the architect acts merely as a draftsman in carrying out the owner's ideas, the owner is failing to secure the benefit of much concentrated intelligence in such matters, which is available, and which his fee to the architect might well obtain for him, to his great advantage.

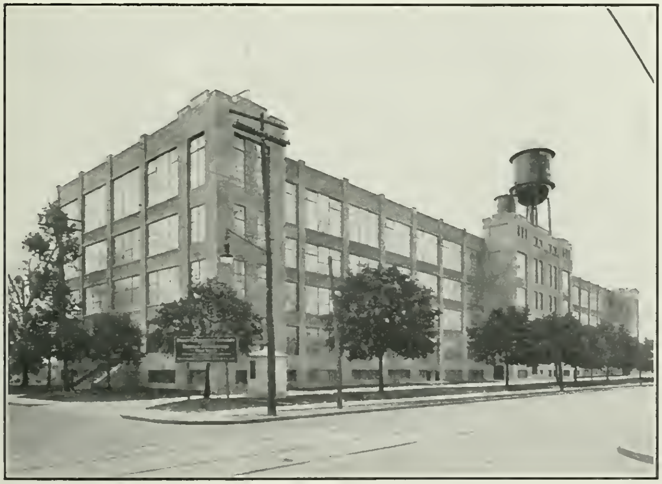

Courtesy of Dwight P. Robinson and Company

Fig. 4 Factory and Office Building Built for Westinghouse Lamp Company

It may be that the architect has outgrown his title and perfected an organization capable of serving an industrial clientele in the manner suggested. There are many who are thus capable, but it is very disconcerting to the factory executive, who imagines that *all* architects are proficient, to find out too late that he is mistaken. Many engineers, because of their restricted training, experience, and practice, are subject to the same criticism as many architects, as regards their ability to handle industrial projects in an adequate way.

It has been well said that industrial plant design has passed through three stages. The first stage was when factories were housed in "just buildings;" the second, when architecture was employed to improve the appearance of such structures; and the third, the present stage, when industrial buildings are designed to "fit the processes" carried on within them, and form an integral part of the production scheme. Many such recently constructed plants may be looked upon as in themselves "big machines" containing and coordinating all the "little machines".

A firm making kitchen utensils recently had plans prepared for a new plant. Proper space was provided for the different departments in accordance with the ideas of the management, the architect incorporating these ideas in working drawings, and making suggestions and improving the layout. Construction was about to start when a factory engineer was consulted relative to some equipment the firm was having designed and constructed for the new plant. His ideas and figures concerning conveying and handling equipment resulted in a complete change in the plans, emphasizing that *what* is to be done, and *how* it is to be accomplished, form the basis of industrial building design. In this case the production layout with all accessory equipment was then worked out and the building fitted to it, instead of, as is often the case, the production processes being fitted into the building. The latter procedure almost inevitably results in awkward and inefficient or wasteful layouts. Conveying equipment was utilized in this instance to handle the utensils between operations and departments, greatly decreasing departmental and machine storage areas and traffic space previously arranged for. Handling charges were reduced and manufacturing speeded up. The building structure was redesigned to fit the new layout scheme and methods of operation.

It was inevitable with the increasing importance, progress, and keener competition in industry, that there should develop specialists in industrial layout work, building design, and construction. Firms handling work of this kind operate under various names, and firm titles are not a sufficient identification or assurance of satisfactory service. The inquiring industrial executive must know the character of their personnel, the results which they have achieved, and their methods of getting results, if he is to judge the probable value of their service to him. Certain firms, due to the volume of business which they have handled in connection with the metal trades industry, the textile industry, etc., have practically become specialists in those lines, but usually firms of this character are capable of handling factory engineering problems in almost any industry.

The staffs of these organizations will include architectural designers, draftsmen, technical specialists, estimators, factory engineers, and production men in addition to executives, construction superintendents, purchasing agents, auditors, clerical help, etc. Such a group acts as a clearing house for the best thought and most advanced ideas and knowledge of production practice and industrial building, and can concentrate this intelligence upon a particular project. Almost invariably the factory owner will find in such an organization more highly skilled talent than he can afford to employ in his own plant. The combined attention of such a group to a particular project is assurance to an owner that no phase of his undertaking will be neglected or handled unintelligently. No single individual, no matter how brilliant, nor even a group of individuals, can hope to rival the teamwork of organizations of this character with their wealth of experience and practice in many industries.

Courtesy of Dwight P. Robinson and Company

FIG. 5 SERVICE BUILDING, DAYTON LIGHT AND POWER COMPANY

As soon as industrial layouts are worked out and processes determined upon—in which work the owner's staff will prove most helpful—suitable enclosing buildings are designed to fit them. Then instead of letting general contracts to contractors who would in turn let subcontracts covering different phases of the work, they will let contracts direct to those firms who will do the work. A resident engineer is then placed on the job to co-ordinate the work of these several contractors, to supervise construction operations, and to expedite the work. In this way pyramiding of costs by the inclusion of profits for the general contractor on the work of sub-contractors is avoided.

The resident engineer on the job co-operates with his office, which awards all contracts, makes all purchases, audits all bills, and looks after all clerical and detail work. This procedure relieves the owner and his organization of all responsibility and annoyance in connection with the project, and places it with those who are experienced in such work. An owner may advise such an organization what he wants to manufacture and how much, and they will create the ideal plant for the purpose, fully equipped and ready to operate, and if desired, provide operating assistance until the plant is functioning smoothly. Moreover, this service offers the same low costs to the man with a $50,000 project as it does to his big competitor.

Courtesy of Dwight P. Robinson and Company

FIG. 6 FACTORY UNIT CONSTRUCTED IN 1920 FOR GEO. D. RYAN CORPORATION

The Problem of Delivery Equipment

By WILFRED ELDRED

Food Research Institute, Stanford University

Index Number
658.7885 Delivering systems

RECENT discussions of the distribution problem have emphasized the importance of local delivery as a contributing factor to the high prices of most goods bought for individual or household consumption. Especially in the case of foodstuffs—milk, meat, bread, ice, fresh fruits and vegetables—is the expense of delivery a significant element in both wholesale and retail prices. Distributors of food products, as well as others, whose business involves the delivery of goods to storekeepers and consumers, are taking a keen interest in the development of more economical delivery methods. Ways and means of reducing the "spread" between producer, manufacturer, or jobber on the one hand, and the retailer or consumer on the other, are engaging the serious study of an increasing number of business men and of specialized research organizations. Co-operative delivery arrangements among merchants, better planning of routes and of delivery service, and engineering studies of the relative cost and efficiency of various types of delivery vehicles, all attest widespread interest in the possibility of improving upon present practices and standards.

An individual plant in the baking industry, by the very nature of its products, is most successfully conducted within the limits of a local territory, of a radius usually not more than 100 miles. Distribution must be immediate and fast, and involves direct wholesale and retail delivery. Mr. Eldred compares the cost and efficiency of horse-drawn, gasoline, and electric vehicles in this service. He concludes that good management and the highest grade and best maintained equipment usually go together.

Probably in no line of business does the delivery problem present as many or as serious difficulties as in the baking industry. Like most food commodities, bakery products must be delivered in clean and sanitary condition, but the nature of the goods requires that extreme care be taken to avoid contamination or exposure to dirt, dust, oil, grease, and fumes. Bread is bulky in comparison with its weight and price, which makes for high delivery costs. Most important of all, it must be delivered to storekeepers and consumers while still fresh, since in the commercial sense it is a highly perishable product; day-old bread is practically unsalable in most localities.

Much the same considerations apply to other bakery products, such as cake, pie, and pastry, which in addition are usually so fragile that they will not stand severe physical handling but require special care in packaging and transportation. It is not strange, therefore, that a considerable part of the consumer's price of bread and other bakery products is represented by the costs of delivery service, and that bakers generally are anxiously seeking methods by which they may reduce these costs.

A statement of the progress being made towards more economical delivery methods in the baking industry may not be without interest to distributors generally. It is hoped that the following discussion may also prove of value to students of current business practice as well as to those who are grappling with delivery problems in the concrete. This article is concerned primarily with the considerations underlying the selection by bakers of certain types of delivery vehicles in preference to other types. Comparison is made of the costs of delivering bakery products by different types of vehicles. The importance of the wage element in the cost of delivery service is also briefly discussed. Finally, some information is presented which bears upon the relative success of bakeries of varying sizes in keeping down their delivery costs.

Investigation of Delivery Vehicles Used by Bakers

Wholesale and retail distribution of bread and bakery products is rapidly on the increase in this country. More and more do the products of the commercial bakery take the place of home-made goods. Not only in the large cities but even in many country towns bakers' bread can be bought today at practically every grocery store. The baking industry has expanded in many cases beyond the consuming capacity of the local market and distribution over a comparatively wide field is now a characteristic feature of the business in most parts of the country. Moreover, insistence by consumers and storekeepers upon freshly baked bread, plus intensified local competition, has necessitated more frequent deliveries to nearby customers. The commercial baker is confronted, therefore, with an increasingly serious problem in giving his trade the service it demands without running up his delivery costs to an unduly high figure.

An important factor contributing to these high costs is the failure by many bakers to select the types of delivery vehicles best suited to the specific conditions of their territory and to the local service requirements. It is certain that large economies in delivery service could be attained if delivery equipment were less frequently selected in a haphazard way and more often on the basis of careful study of experience records.

As part of a general survey of the economic problems of the baking industry, the Food Research Institute of Stanford University, California, undertook in 1923 an investigation covering the experience of bakers with various types of delivery equipment. Several months were given to a detailed study of the practice and operating results of a number of concerns in widely separated cities, that kindly placed their records at the disposal of the Institute. As a result of these preliminary studies certain tentative conclusions began to take shape, but a number of questions became manifest, the answers to which obviously called for a much broader basis of factual information than could be secured by direct personal solicitation. For this additional information resort was had to the questionnaire method of inquiry.

In June 1923, questionnaires were sent to a selected list of bakers located in all parts of the United States, asking them to report their opinions concerning the advantages and disadvantages of each type of delivery vehicle of which they had experience, and to give the reasons which had prompted them to select the types they were using. They were also asked to describe the operating conditions in their respective localities, including length of routes, number of stops, character of roads, etc., and to supply information from their records concerning the cost of making deliveries by different types of vehicles. An effort was made to reach all classes of baking concerns—large, medium, and small—that were presumed to have an interest in delivery problems. About one hundred usable returns were received from bakers in 32 states, two Canadian provinces, and Hawaii. The following discussion is based primarily on an analysis of these reports, although it is supplemented by information drawn from a variety of other sources.

Proportions in Which Bakers Use the Types of Vehicles Available

The 100 bakeries, whose reports have been made the basis of this analysis, made use of the various types of delivery vehicles in the proportions indicated in Table 1. The concerns reporting are classified in the table in three groups, on the basis of approximate daily output of bread, as follows: (1) plants producing in excess of 20,000 lb. daily; (2) plants producing from 5,000 to 20,000 lb. daily; (3) plants producing under 5,000 lb. daily. In the main the bakeries reporting were wholesale concerns, although about half a dozen house-to-house retail distributors are included. Altogether they operated 2,069 delivery routes in 1922 and maintained 2,353 vehicles to serve these routes, divided as follows: 740 horse wagons, 1,218 gasoline trucks, and 395 electric vehicles.

TABLE 1. DISTRIBUTION OF 100 USERS OF VARIOUS TYPES OF DELIVERY VEHICLES IN THE BAKING INDUSTRY, 1923

Size of Bakery in Daily Output (Lb.)	Total of Concerns Reporting	Number of Routes Operated	Number of Bakeries Using			
			Horse-Wagons	Light Gasoline Trucks[1]	Heavy Gasoline Trucks[2]	Electric Trucks
Over 20,000.	30	1,400	18	26	15	16
5,000 to 20,000	47	586	15	39	22	6
Under 5,000...	23	83	2	21	7	..
All bakeries	100	2,069	35	86	44	22

[1] Defined as ½ ton to ¾ ton.

[2] Defined as 1 ton and over.

Practically nine-tenths of all the concerns reporting used either light or heavy gasoline car equipment, about one-third used horse-wagons, and slightly over one-fifth used electric trucks. The three groups of bakeries classified by size show some interesting differences with respect to the kinds of delivery vehicles they found best adapted to their local service requirements.

Thus in the group of 23 smaller concerns, which were located predominantly in country towns or small cities, the high proportion of users of light gasoline cars is especially noteworthy. Their reports indicated that nearly half of this group of 23 bakeries were making deliveries to points up to 30 or 40 miles distant from the plant; two of them were regularly sending their heavier trucks distances in excess of 100 miles. Only two bakers in this entire group reported the use of horse-wagons in their delivery operations, while none reported electrics. Less than one per cent of all the horse-wagons reported were used by this group of relatively small concerns.

The group of 47 bakeries of intermediate size were much more evenly distributed as to types of delivery equipment used. Six of this group reported the use of electric trucks; nearly one-third used horses and wagons, chiefly in combination with gasoline trucks. Light gasoline cars were used by 39 of the 47 bakers reporting, and heavy gas trucks by 22. Here again, the reports disclose, bakers are reaching out very long distances to secure business. Half of the concerns in this group using gasoline trucks reported routes having a length of 40 miles or more; five covered distances in excess of 100 miles daily.

The 30 bakeries in the group of larger concerns were located, with very few exceptions, in cities having over 200,000 population. These concerns showed the most even distribution of the three groups with respect to the several types of delivery equipment. Nearly two-thirds of them used horse-wagons, in every instance but one, in combination with other types of vehicles. Seven reported that they were using all of the 3 major types of vehicles; 10 combined horse-wagons and gas cars; 7 combined gas cars and electric vehicles. Three-fourths of all the horse-wagons and nine-tenths of all the electrics used by the 100 bakers reporting were in the service of this group of large city bakeries. It seems that the very large cities offer the best opportunity to utilize a variety of delivery vehicles, confining each type to the specific conditions of service for which it is peculiarly fitted. At the same time the risk of loss through improper selection of vehicles is so great in the case of the large concern operating many routes that it becomes a matter of great importance to determine precisely the conditions in which each type of equipment is best employed. On the other hand, the expense of maintaining several different types of vehicles concurrently is usually considerable; it does not pay to continue the period of experimentation too long.

The Use of the Gasoline Truck

Nearly three-fourths of the firms using gasoline trucks indicated that speed was a paramount object in their calculations; a much smaller number mentioned the greater suitability of gas trucks for long-distance operations as an important consideration. A high price is evidently being paid for speed, since at least half those using gasoline trucks found them expensive to operate, chiefly because of their rapid physical depreciation. This was especially true of the light gasoline car. The general tendency of drivers to go too fast, with resultant high costs of operation and maintenance, was commented upon by a number of bakers. One remarked: "They will not stand the grief of fast driving." Another said: "Unless governed they are driven too fast and depreciate rapidly."

Many users of the lighter types of gasoline trucks were in agreement that they do not stand up under routine delivery service where substantial loads must be carried every day. One baker remarked: "They fall apart." A fair proportion of users, however, reported that they had found the light gasoline car economical and reliable in operation. A number mentioned the low first cost of this type of truck as a factor favoring its use, while others indicated the ease of securing repair parts as a reason for preferring it to other types which might be better suited to the local conditions of service. About two-fifths of the bakers using light gas trucks mentioned their cleanliness and better appearance (as compared with horse-drawn vehicles) as an advantage. It is clear from the reports, however, that the major factor leading to the general preference for the light gasoline truck is its speed in delivering the goods. Whatever the offsets and inadequacies in other respects, this consideration appears to have been decisive with most users in their selection and continued use of this type of vehicle.

Substantially the same considerations apply to the heavier types of gasoline trucks, which are used extensively to serve suburban and distant customers. Ability to cover ground—meaning distance—to carry large loads, and to make speed, were mentioned, together with reliability, by a large proportion of bakers using such trucks. Here again there is some offset, perhaps inevitable, in the high costs of maintenance experienced by a number of users. Several bakers objected also to the large initial investment necessary in buying heavy trucks.

The Use of the Horse-Wagon

Of the 35 bakers reporting the use of horse-wagons, 30 mentioned economy in operation and upkeep, 27 reliability, and 25 low first cost, as considerations which had influenced them in the selection of this type of equipment. The factors most frequently mentioned as drawbacks to the use of the horse and wagon were low speed, inability to cover long routes or to carry large loads, and uncleanliness. More than half the concerns reporting their experience with horse-wagons (some 80 in all) had replaced them with some other type of vehicle—gasoline trucks in most cases. Here again the desire for greater speed was stressed by most bakers making such substitution; some also appear to have been influenced by the desire for greater cleanliness in their delivery equipment. A few had found horses and wagons expensive to maintain; several had gone to other forms of equipment in order to extend their delivery area over wider distances.

The horse-wagon appears to be the type of equipment most commonly used for house-to-house delivery. A number of bakers engaged in this form of distribution stated that the horse soon comes to know the route and will go along without guidance while the driver is walking from house to house. A large Canadian retail distributor reported, however, that he found the electric truck to be ideal for this kind of service, involving short hauls and frequent stops, and used horses only where the roads were too bad for electrics to get through easily.

The Use of the Electric Truck

The electric delivery truck appears to be winning the good opinion of an increasing number of bakers. Nine-tenths of the concerns reporting their use emphasized the operating economy of the electric truck as the principal argument in their favor; a similar proportion mentioned their superior cleanliness and good appearance, whether compared with horse-wagons or gasoline trucks, as advantages worth consideration. The simplicity of construction of the electric vehicle, with resulting ease of operation, and its freedom from mechanical difficulties or expensive repairs, were commended by many bakers. These features, they reported, enable the driver to pay more attention to his job of selling bread and to his personal appearance, since he does not need to stop on the road to change tires or make repairs. Consequently a better type of deliveryman can be employed, one who is essentially a salesman rather than a truck-driver.

On the other hand, the electric vehicle's limited range of operation was found to be a drawback by some bakers; others reported it unsuited to hilly territory where roads are poor, or to regions having severe winter weather. Of the bakers who have used electrics in such regions a number have experienced trouble due to loss of power with consequent stalling in deep snow towards the end of the day's run. It seems probable that in the early days the manufacturers of electric trucks did not give sufficient attention to providing reserve battery power against such emergencies. Moreover, the batteries themselves had not been developed to a very high standard of excellence. These defects seem to have been largely remedied at the present time.

The low speed of the electric vehicle was considered by many bakers as a conclusive argument against it. Quite as many, however, emphasized the controlled speed of the electric as one of its main advantages for delivery purposes. Much evidently depends upon the length and character of the routes, number of stops, open space between stops, traffic conditions, and the like. It has been pointed out, as a result of actual test, that with its rapid acceleration and ease of control the electric truck often makes better time than the gas car in covering routes having a great many stops. On the other hand, where routes are very long and stops infrequent, and the traffic regulations permit high rates of speed, the electric vehicle is clearly out of place.

The high initial cost of the electric vehicle was emphasized by a number of bakers, including users as well as non-users, as an obstacle to its more general adoption. This difficulty appears to be offset to some extent, however, by the circumstance that it is often necessary to maintain fewer electric vehicles than other types of equipment, to serve a given number of routes, because they are not so liable to break down and fewer extra units are necessary to replace those temporarily out of commission. Concerns operating many routes may thus sometimes find that it costs less to equip them with electrics than with other types of vehicles.

Costs of Delivery Service by Different Types of Vehicles

Among the questions raised by the inquiry of the Food Research Institute was one concerning unit costs of delivery service. Bakers were asked to report the total quantity (in pounds) and value (in dollars) of the bread and other products delivered by the several classes of vehicles they used. They were also asked to report the cost of operating and maintaining these different vehicles. The information given was in many instances incomplete, and in others was based on estimates rather than exact knowledge or careful record of the facts. However, enough data were forthcoming to permit approximate estimates of unit costs for the different types of delivery equipment and for bakeries of various sizes.

These estimates are given in Tables 2 and 3. More bakers were able to report their sales in dollars than in pounds. In order to facilitate comparison the data on costs have been converted into percentages of sales, *i. e.*, cents per dollar's worth of goods delivered by each type of vehicle or group of bakeries, and the figures given in the tables are expressed on this basis. Table 2 presents average delivery costs in 1922 for 54 firms which operated 351 horse-wagons, 606 gasoline trucks, and 112 electric vehicles.

TABLE 2. AVERAGE DELIVERY COSTS PER DOLLAR'S WORTH OF GOODS DELIVERED BY EACH TYPE OF VEHICLE (IN CENTS)

TYPE OF VEHICLE	NUMBER OF REPORTS FOR EACH TYPE	COSTS LESS DRIVERS' COMPENSATION	DRIVERS' WAGES AND COMMISSIONS	TOTAL DELIVERY COSTS
Electric trucks...	8	5.58	8.24	13.82
Horse-wagons..	17	6.21	10.30	16.51
Gasoline trucks...	56	8.29	8.11	16.40
All types . .	81	7.59	8.58	16.17

Some bakers undoubtedly omitted certain items from their cost calculations or may have overstated their sales, which leads to the same result, while others probably understated their sales or included among their costs items which should have been omitted. While the range of costs as reported was considerable, it is believed that the averages presented above are at least representative and may be fairly compared with each other.

Granting the representative character of the reports and of the averages computed from them, it seems fairly clear that the typical cost of delivering bakery products by gasoline truck considerably exceeds that of delivery by horse-wagon or electric vehicle, taking account of vehicle costs alone. This is due in part, no doubt, to the greater distances over which goods are carried by gasoline trucks. In part it seems to be due to the heavier expense for maintenance and repairs inherent to this type of vehicle.

This is far from being the whole story, however. When the comparison is made on the basis of the average expenses for deliverymen's wages and commissions (the second column of the table), the gasoline truck makes a much better showing. The 56 reports received for gasoline car deliveries showed an average cost for drivers' compensation of 8.11 cents per dollar's worth of goods delivered. Electric vehicles ranked second, with an average cost of 8.24 cents, while the concerns reporting on horse-wagons paid their drivers an average of 10.30 cents per dollar's worth of goods delivered. The relatively poor showing of the latter group is due in part to the fact that they included a disproportionate number of concerns making house-to-house deliveries at retail. Such distributors usually have a smaller average sale per route than wholesale bakeries and also pay their deliverymen higher rates of commission on sales. Comparison of the three types of equipment with respect to the average daily sale per route gives the following results:

Horse-wagon routes, 20 firms reporting on 340 routes.	$66.70
Gasoline truck routes, 54 firms reporting on 636 routes	73.70
Electric vehicle routes, 8 firms reporting on 126 routes	78.80

These results aid in the interpretation of the third column of the table, showing total average delivery costs for each of the three types of equipment. Electric vehicles, having the highest average daily sale per route, showed the lowest total delivery cost per dollar of sales. Gasoline trucks, with an average sale per route some 6 per cent less than the electrics, had a total delivery cost about 18 per cent higher. Horse wagons, with a still lower average sale per route, had the highest figure of all for total cost of delivery per dollar's worth of goods sold.

Checking the Delivery Costs

The data presented above for vehicle costs (the first column of Table 2) might with advantage be compared with similar figures recently published by the W. E. Long Company, a well-known firm of bakery cost accountants. This concern conducts a unique accounting service for a considerable group of bakers whose plants are located at widely separated points throughout the country. Between 30 and 40 of these bakeries, including the best managed among them, regularly report their operating results to the W. E. Long Company, which prepares each month a comparative cost report showing in detail how each of the reporting concerns compares with the general average for the whole group with respect to each important item of cost.

According to a statement made by the vice-president of the W. E. Long Company at a recent gathering of bakers,[1] the average costs of bread delivery by the clients of this company during a typical operating period, expressed as cents per 100 lb. of goods actually delivered by each type of vehicle, were as follows: by horse and wagon, 34 cents; by electric truck, 43 cents; by gasoline truck, 74 cents. The corresponding figures for the concerns reporting to the Food Research Institute[2] (covering mainly the experience of 1922 and 1923), were, for horses and wagons, 50 cents; for electric trucks, 45 cents; for gasoline trucks, 66 cents. For ready comparison the two sets of results for vehicle costs are placed in parallel:

	FOOD RESEARCH INSTITUTE	W. E. LONG COMPANY
Horse-wagons	50 cents	34 cents
Electric vehicles	45 cents	43 cents
Gasoline trucks	66 cents	74 cents

Except for the horse-wagon costs the two sets of figures are in fairly close agreement, considering the difference in number of concerns involved, methods of estimating costs, and periods of time represented. The rather wide divergence with respect to horse-wagon costs is instructive and illuminating, for it gives an excellent idea of the very great differences in operating results which may be expected between different concerns. A high proportion of the bakers reporting to the W. E. Long Company are probably among the most progressive in the country, and it is to be expected that those among them who continue to use horse-wagons in delivery service should succeed in getting high efficiency from such equipment. Those reporting to the Food Research Institute, on the other hand, probably constitute a group more nearly typical of the baking industry as a whole. Probably no better illustration could be found of the warning that average costs must be used with caution; due allowance should always be made for essential differences in conditions when making such comparisons.

Variations in Delivery Cost According to Size of Business

Bakeries of moderate size appear to use their delivery equipment more economically than either the very large or the very small concerns. Table 3 below, which presents average costs for three groups of bakeries classified according to size, brings out very readily the differences between them. Thus the group of large concerns, those having a daily output of more than 20,000 lb., stood highest with respect to both vehicle costs and deliverymen's compensation. The group of small bakeries, those having a daily output of less than 5,000 lb., had the lowest average figure for drivers' wages and commissions, but this was more than offset by their comparatively high vehicle costs. Fifteen of the 16 reports received from this group of concerns were for gasoline trucks, since these particular bakeries used that type of equipment almost exclusively.[3] The concerns of intermediate size had the lowest figure for total cost, despite the fact that most of the house-to-house retailers were included in this group.

TABLE 3. AVERAGE DELIVERY COSTS PER DOLLAR'S WORTH OF GOODS DELIVERED, BY BAKERIES OF VARIOUS SIZES (IN CENTS)

SIZE OF BAKERY IN DAILY OUTPUT (LB.)	NUMBER OF REPORTS FROM EACH GROUP	COSTS LESS DRIVERS' COMPENSATION	DRIVERS' WAGES AND COMMISSIONS	TOTAL DELIVERY COSTS
Under 5,000	16	7.99	7.72	15.71
5,000 to 20,000	40	6.85	8.65	15.50
Over 20,000	25	8.53	9.02	17.55
All	81	7.59	8.58	16.17

The conclusion that delivery costs are lower for bakeries of moderate size appears to be in agreement with the consensus of well-informed opinion in the trade. These concerns are usually located in communities large enough to absorb all or most of the output without having to resort to excessively long hauls, whereas in small towns even a bakery of modest size frequently finds it necessary to send its goods a considerable distance in order to find enough customers. In large cities, on the other hand, there is a tendency for ambitious and successful bakers to build very large plants—plants so large, in fact, that the volume of goods produced outruns the consuming capacity of the immediate local market. Hence the delivery area has been expanded over a greater and greater territory, with rising costs as a necessary consequence of this extended radius.

Summary and Conclusions

Sweeping generalizations are to be avoided. The evidence presented in the foregoing discussion, while not as extensive at some points as might be desired, still appears to justify certain more or less definite conclusions. Much of this evidence, it may be noted, is in rather close agreement with information derived from first-hand contact with the baking industry and other businesses having similar delivery problems. The disagreements and apparent inconsistencies which occur in the data are largely the result of differences in efficiency of management as between individual business concerns. Some firms succeed in getting only mediocre performance from even the best types of equipment, while others get along quite well with delivery vehicles of distinctly inferior design, or with types which are not well adapted to the specific conditions of their service requirements. While due account must be taken of individual differences in managerial ability, it is probably true that the best business management will be found associated, sooner or later, with the best mechanical equipment and the most efficient methods. By and large, it is believed that the evidence presented above reveals certain definite tendencies which are typical for the baking industry, as a whole, and may well be characteristic of other businesses also.

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[1] See address of D. P. Chindblom at convention of New York Bakers Association, Buffalo, N. Y., May 27, 1924, reported in *Bakers' Weekly*, June 14, 1924, p. 68.

[2] Converting dollar's worth of goods into hundred weight on the basis of an average of 8 cents per lb.—probably a fairly close approximation.

[3] See Table 1.

Horse-Drawn Vehicles—Gasoline Trucks

The horse-drawn vehicle is limited to short-haul service where frequent stops are required and where speed is not important. Even here motorized equipment is forcing the horse-wagon more and more into the background. Curiously enough its stronghold appears to be the large city rather than the small town. The reasons most frequently given by bakers for their continued use of the horse and wagon in preference to other types of delivery vehicles were—economy, reliability, and low first cost. Outstanding disadvantages mentioned were—low speed, limited range of action, inability to carry large loads, and uncleanliness.

The gasoline truck is the type of delivery vehicle used by most bakers at the present time and used in largest numbers. It is preferred because of its speed, large radius of activity, and ability to carry large loads. The chief offsets mentioned by bakers were: high costs of operation and upkeep; rapid depreciation; and enforced loss of time from delivery service because of need for frequent repairs, with consequent annoyance and considerable expense.

Electric Trucks

The electric vehicle has made comparatively little headway until recent years in bakery delivery service except in the larger cities. Out of nearly 400 electric trucks on which reports were obtained, only 20 were in cities of less than 100,000 population. The electric finds its greatest field of usefulness in comparatively short runs, especially where stops are numerous—essentially the type of service characteristic of food delivery in large cities. Reasons given by bakers for their adoption of electric delivery vehicles emphasized economy in operation, reliability, cleanliness, and simplicity of control. Objections most frequently mentioned were: limited range of operation; low speed; mechanical difficulties in hilly territory, especially in severe winter weather; and high initial cost. The evidence is not altogether in agreement with respect to some of these latter points. The controlled speed of the electric vehicle, for instance, was considered by some users to be an advantage. Others operating electrics had experienced no difficulty in hill climbing or driving through snow. High initial cost was offset to some extent by long life and relative freedom from loss of time on account of overhauls.

It is significant that very few bakers, having once tried electric vehicles, have replaced them with other types of equipment. On the other hand, several reported that they believed the electric truck to be better suited to the conditions of their delivery service than the types of vehicles they were using, and were seriously considering their adoption. The conclusion seems warranted by the evidence that within the range of operation to which it is adapted the electric vehicle is the most satisfactory of all types for bakers, especially where large fleets are maintained.

Conclusions as to Cost

Vehicle costs appear to be considerably higher for gasoline trucks than for either horse-wagons or electric vehicles. Drivers' wages and commissions, on the other hand, absorbed a much higher percentage of the value of goods delivered by horse-wagon than of goods delivered by motorized equipment. Average costs per dollar's worth of goods delivered by 54 concerns operating 351 horse-wagons, 606 gasoline trucks, and 112 electric vehicles, in 1922, were as follows:

	VEHICLE COSTS CENTS	DRIVERS' COMPENSATION CENTS	TOTAL DELIVERY COSTS CENTS
For electric trucks	5.6	8.2	13.8
For horse-wagons	6.2	10.3	16.5
For gasoline trucks	8.3	8.1	16.4

Bakeries of moderate size deliver their goods more economically than either the very large or the very small concerns. They appear to have much lower vehicle costs and are intermediate between the large and small units with respect to deliverymen's compensation. The largest bakeries have the highest average costs with respect to both items—a reflection, perhaps, of the pressure of urban conditions on business costs.

Conditions Governing Selection of Equipment

A final word of caution. No attempt can be made in the present state of information to say the last word on the proper selection of delivery equipment. Probably the most that can be expected at this stage is to call attention to the conditions, physical and commercial, which favor the use of one type of vehicle rather than another. No two cases are alike in all particulars; every concern has its own individual problems which call for detailed study and careful experimentation. To emphasize the need for such study and experiment has been a chief purpose of this discussion. With the experience of other concerns as a background, each individual business enterprise must determine for itself what type or types of vehicles, all things considered, are best adapted to the conditions of its service. Once this is determined, the further question may be considered—whether modification of present practice is worth the cost of making the change.

Determining Profits in Advance

Working Plans for Profit—III

By G. CHARTER HARRISON

Consultant in Management

THE accountant is at last entering upon his inheritance and taking his proper place in the ranks of industry.[1] Heaven knows he was long enough in making a start but he is now making up for lost time with a vengeance. The vivid interest which accountants are taking today in budgets and the predetermination of profits and costs is one of the most significant and encouraging signs of the times, and represents a virtual revolution in accounting viewpoint and procedure to the great benefit of industry.

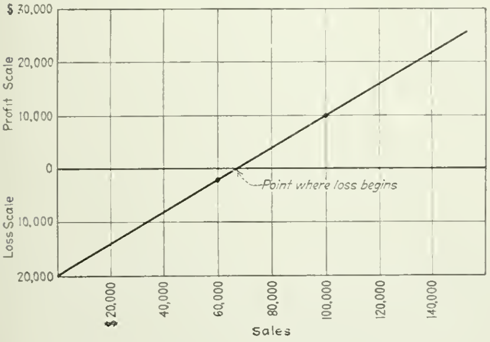

FIG. 6 PROFITS AT VARYING SALES VOLUMES

The important step was the change in viewpoint. Once this change was accomplished, the modification of methods to fit in with the changed viewpoint presented no particular difficulty. It takes time, of course, to develop a complete new technique of accounting but that this would be done once the important first step was taken, was a foregone conclusion.

Until very recently, as has so often been pointed out, the accountant regarded his sphere as being confined to the recording of past events. The average comptroller considered that his full duty had been performed if he promptly reported the fact that the horse was stolen; it was no function of his to see that the stable door was locked so that the sad event could not occur.

The engineer, on the other hand, with his foreseeing mind realized very fully that the accountant would never be a really constructive force in industrial progress until he embraced what we may call the engineering viewpoint of accounting, and some engineers expressed themselves very forcibly on this subject. As might be expected, these criticisms of accountants by engineers resulted in a considerable breach between the professions and there developed a tendency on the part of many engineers to take the stand that if the accountant refused to change his methods to conform to the trend of advanced industrial thought and continued to hold back the procession, it was the duty of the engineer to step in and take over the accounting functions at least as far as these pertained to factory operations. One engineering writer even went so far as to state:

Index Number
658.14 Financial control
657.4 Accounting

> The employment of an expert accountant to devise and install a cost system in a manufacturing and repairing plant is an absurdity

which statement, though obviously absurd, to use the writer's own word, illustrates very forcibly the viewpoint of engineers at the time the statement was made.

Today the situation happily is entirely changed. Recently four engineering societies and the National Association of Cost Accountants organized joint sessions for the discussion of "Budgeting for Business Control."

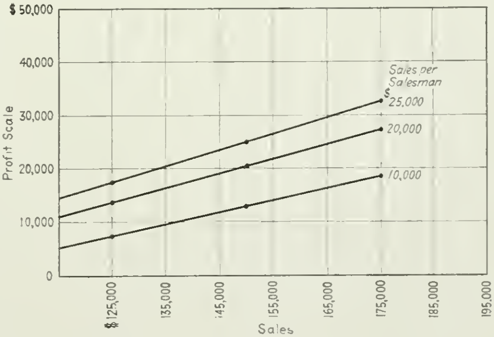

FIG. 7 NET PROFITS AT VARYING TOTAL SALES VOLUMES AND AT VARYING SALES PER SALESMAN

In the early part of 1922 I made the following statement:

> It is in transitional times like these that the exercise of foresight is of supreme importance to the industrial executive and during the past year illustrations of the disastrous results due to a lack of this quality have not been wanting.

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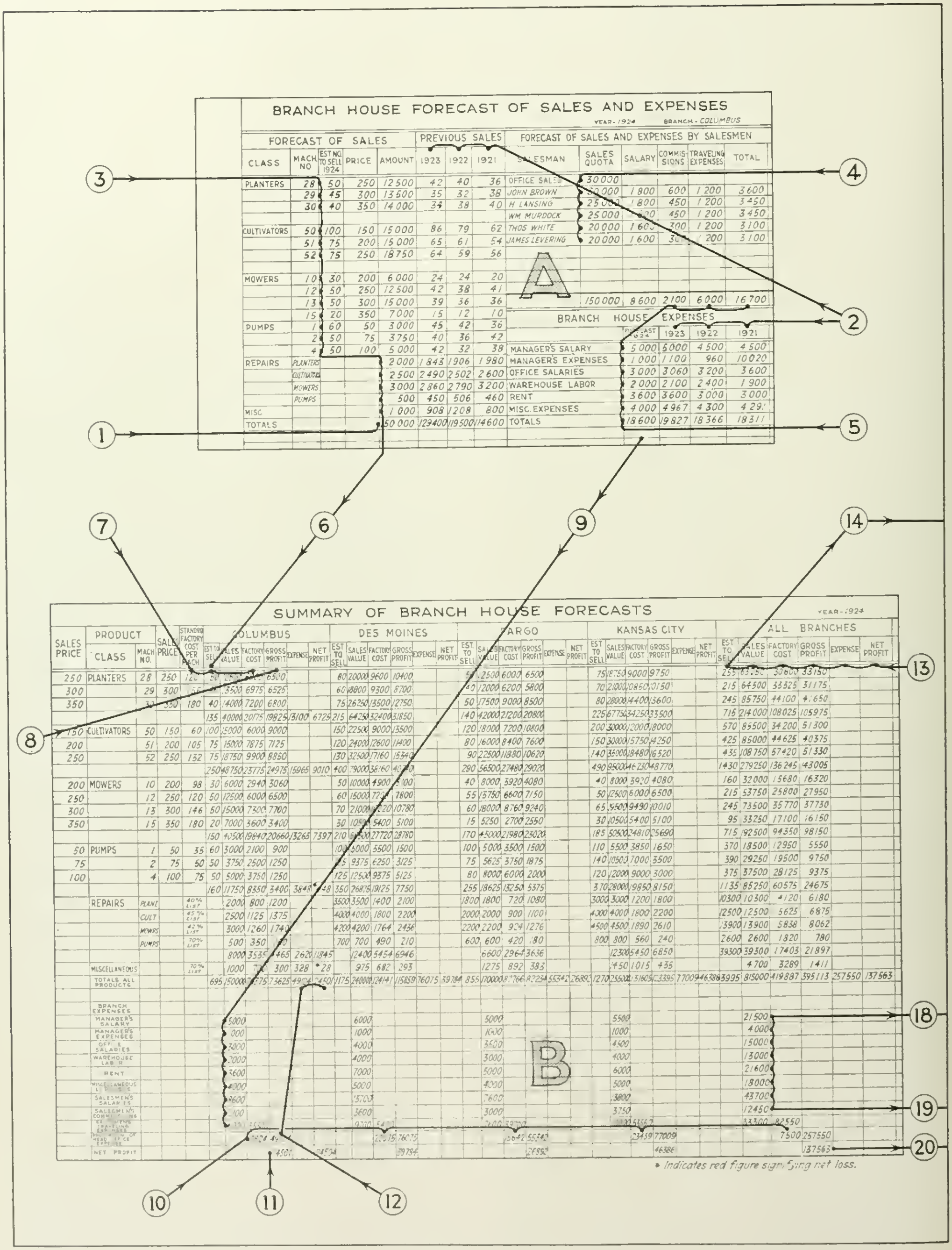
[1] See MANAGEMENT AND ADMINISTRATION for October 1924, p. 361, and November 1924, p. 491.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BRANCH HOUSE FORECAST OF SALES AND EXPENSES

YEAR - 1924 BRANCH - COLUMBUS

FORECAST OF SALES					PREVIOUS SALES		
CLASS	MACH NO	EST NO TO SELL 1924	PRICE	AMOUNT	1923	1922	1921
PLANTERS	28	50	250	12 500	42	40	36
	29	45	300	13 500	35	32	38
	30	40	350	14 000	34	38	40
CULTIVATORS	50	100	150	15 000	86	79	62
	51	75	200	15 000	65	61	54
	52	75	250	18750	64	59	56
MOWERS	10	30	200	6 000	24	24	20
	12	50	250	12 500	42	38	41
	13	50	300	15 000	39	36	36
	15	20	350	7000	15	12	10
PUMPS	1	60	50	3 000	45	42	36
	2	50	75	3750	40	36	42
	4	50	100	5 000	42	32	38
REPAIRS	PLANTERS			2 000	1 843	1906	1 980
	CULTIVATORS			2 500	2490	2502	2 600
	MOWERS			3000	2 860	2790	3200
	PUMPS			500	450	506	460
MISC				1 000	908	1208	800
TOTALS				150 000	129400	119500	114600

FORECAST OF SALES AND EXPENSES BY SALESMEN

SALESMAN	SALES QUOTA	SALARY	COMMISSIONS	TRAVELING EXPENSES	TOTAL
OFFICE SALES	30000				
JOHN BROWN	30 000	1 800	600	1 200	3600
H LANSING	25 000	1 800	450	1 200	3 450
WM MURDOCK	25 000	[illegible]	450	1 200	3 450
THOS WHITE	20 000	1 600	300	1 200	3 100
JAMES LEVERING	20 000	1 600	300	1 200	3 100
	150 000	8 600	2 100	6 000	16 700

BRANCH HOUSE EXPENSES

	FORECAST 1924	1923	1922	1921
MANAGER'S SALARY	5 000	5000	4 500	4 500
MANAGER'S EXPENSES	1 000	1 100	960	10020
OFFICE SALARIES	3 000	3 060	3 200	3 600
WAREHOUSE LABOR	2 000	2 100	2 400	1 900
RENT	3 600	3600	3 000	3 000
MISC. EXPENSES	4 000	4 967	4 300	4 29[illegible]
TOTALS	18 600	19 827	18 366	18311

SUMMARY OF BRANCH HOUSE FORECASTS

YEAR - 1924

SALES PRICE	PRODUCT CLASS	MACH NO.	SALES PRICE	STANDARD FACTORY COST PER MACH	COLUMBUS EST TO SELL	SALES VALUE	FACTORY COST	GROSS PROFIT	EXPENSE	NET PROFIT
250	PLANTERS	28	250	[illegible]	50	[illegible]	[illegible]	6500		
300		29	300	[illegible]	[illegible]	13500	6975	6525		
350		[illegible]	350	180	40	14000	7200	6800		
					135	40000	20175	19825	13100	6725
150	CULTIVATORS	50	150	60	100	15000	6000	9000		
200		51	200	105	75	15000	7875	7125		
250		52	250	132	75	18750	9900	8850		
					250	48750	23775	24975	15965	9010
200	MOWERS	10	200	98	30	6000	2940	3060		
250		12	250	120	50	12500	6000	6500		
300		13	300	146	50	15000	7300	7700		
350		15	350	180	20	7000	3600	3400		
					150	40500	19840	20660	13265	7397
50	PUMPS	1	50	35	60	3000	2100	900		
75		2	75	50	50	3750	2500	1250		
100		4	100	75	50	5000	3750	1250		
					160	11750	8350	3400	3848	•[illegible]48
	REPAIRS	PLANT		40% LIST		2000	800	1200		
		CULT		45% LIST		2500	1125	1375		
		MOWRS		42% LIST		3000	1260	1740		
		PUMPS		70% LIST		500	350	[illegible]		
						8000	3535	[illegible]465	2620	1845
	MISCELLANEOUS			70% LIST		1000	[illegible]	300	328	•28
	TOTALS ALL PRODUCTS				695	150000	[illegible]	73625	[illegible]	[illegible]

PRODUCT CLASS	MACH NO.	DES MOINES EST TO SELL	SALES VALUE	FACTORY COST	GROSS PROFIT	EXPENSE	NET PROFIT
PLANTERS	28	80	20000	9600	10400		
	29	60	18800	9300	8700		
	30	75	26250	13500	12750		
		215	64250	32400	31850		
CULTIVATORS	50	150	22500	9000	13500		
	51	120	24000	12600	11400		
	52	130	32500	17160	15340		
		400	79000	38160	40[illegible]		
MOWERS	10	50	10000	4900	[illegible]		
	12	60	15000	[illegible]	7800		
	13	70	21000	[illegible]	10780		
	15	30	[illegible]	5400	5100		
		210	[illegible]	27720	28780		
PUMPS	1	100	5000	3500	1500		
	2	[illegible]	9375	6250	3125		
	4	125	12500	9375	5125		
		350	26875	19125	7750		
REPAIRS	PLANT	3500	3500	1400	2100		
	CULT	4000	4000	1800	2200		
	MOWRS	4200	4200	1764	2436		
	PUMPS	700	700	490	210		
			12400	5454	6946		
MISCELLANEOUS			975	682	293		
TOTALS ALL PRODUCTS		1175	240000	124141	115859	76075	39784

PRODUCT CLASS	MACH NO.	FARGO EST TO SELL	SALES VALUE	FACTORY COST	GROSS PROFIT	EXPENSE	NET PROFIT
PLANTERS	28	[illegible]	12500	6000	6500		
	29	40	12000	6200	5800		
	30	50	17500	9000	8500		
		140	42000	21200	20800		
CULTIVATORS	50	120	18000	7200	10800		
	51	80	16000	8400	7600		
	52	90	22500	11880	10620		
		290	56500	27480	29020		
MOWERS	10	40	8000	3920	4080		
	12	55	13750	6600	7150		
	13	60	18000	8760	9240		
	15	15	5250	2700	2550		
		170	45000	21980	23020		
PUMPS	1	100	5000	3500	1500		
	2	75	5625	3750	1875		
	4	80	8000	6000	2000		
		255	18625	13250	5375		
REPAIRS	PLANT	1800	1800	720	1080		
	CULT	2000	2000	900	1100		
	MOWRS	2200	2200	924	1276		
	PUMPS	600	600	420	180		
			6600	2964	3636		
MISCELLANEOUS			1275	892	383		
TOTALS ALL PRODUCTS		855	170000	87766	82234	55342	2689[illegible]

PRODUCT CLASS	MACH NO.	KANSAS CITY EST TO SELL	SALES VALUE	FACTORY COST	GROSS PROFIT	EXPENSE	NET PROFIT
PLANTERS	28	75	18750	9000	9750		
	29	70	21000	10850	10150		
	30	80	28000	14400	13600		
		225	67750	34250	33500		
CULTIVATORS	50	200	30000	12000	18000		
	51	150	30000	15750	14250		
	52	140	35000	18480	16520		
		490	95000	46230	48770		
MOWERS	10	40	8000	3920	4080		
	12	50	12500	6000	6500		
	13	65	19500	9490	10010		
	15	30	10500	5400	5100		
		185	50500	24810	25690		
PUMPS	1	110	5500	3850	1650		
	2	140	10500	7000	3500		
	4	120	12000	9000	3000		
		370	28000	19850	8150		
REPAIRS	PLANT	3000	3000	1200	1800		
	CULT	4000	4000	1800	2200		
	MOWRS	4500	4500	1890	2610		
	PUMPS	800	800	560	240		
			12300	5450	6850		
MISCELLANEOUS			1450	1015	435		
TOTALS ALL PRODUCTS		1270	255000	131605	123395	77009	46386

PRODUCT CLASS	MACH NO.	ALL BRANCHES EST TO SELL	SALES VALUE	FACTORY COST	GROSS PROFIT	EXPENSE	NET PROFIT
PLANTERS	28	255	[illegible]	30600	33150		
	29	215	64500	33325	31175		
	30	245	85750	44100	41650		
		715	214000	108025	105975		
CULTIVATORS	50	570	85500	34200	51300		
	51	425	85000	44625	40375		
	52	435	108750	57420	51330		
		1430	279250	136245	143005		
MOWERS	10	160	32000	15680	16320		
	12	215	53750	25800	27950		
	13	245	73500	35770	37730		
	15	95	33250	17100	16150		
		715	192500	94350	98150		
PUMPS	1	370	18500	12950	5550		
	2	390	29250	19500	9750		
	4	375	37500	28125	9375		
		1135	85250	60575	24675		
REPAIRS	PLANT	10300	10300	4120	6180		
	CULT	12500	12500	5625	6875		
	MOWRS	13900	13900	5838	8062		
	PUMPS	2600	2600	1820	780		
		39300	39300	17403	21897		
MISCELLANEOUS			4700	3289	1411		
TOTALS ALL PRODUCTS		3995	815000	419887	395113	257550	137563

	COLUMBUS	DES MOINES	FARGO	KANSAS CITY	ALL BRANCHES
BRANCH EXPENSES					
MANAGER'S SALARY	5000	6000	5000	5500	21500
MANAGER'S EXPENSES	[illegible]	1000	1000	1000	4000
OFFICE SALARIES	3000	4000	3500	4500	15000
WAREHOUSE LABOR	[illegible]	4000	3000	4000	13000
RENT	3600	7000	5000	6000	21600
MISCELLANEOUS EXPENSES	4000	5000	4000	5000	18000
SALESMEN'S SALARIES	[illegible]	13700	7600	13800	43700
SALESMEN'S COMMISSIONS	[illegible]	3600	3000	3750	12450
SALESMEN'S TRAVELING EXPENSES	[illegible]	[illegible]	[illegible]	[illegible]	33300 82550
PRO RATA OF HEAD OFFICE EXPENSE	[illegible]	22075 76075	[illegible] 55342	23459 77009	7500 257550
NET PROFIT	[illegible]	39784	26892	46386	137563

• Indicates red figure signifying net loss.

FIG. 8 BRANCH HOUSE FORECASTS OF SALES AND EXPENSES AND SUMMARY OF FORECASTS

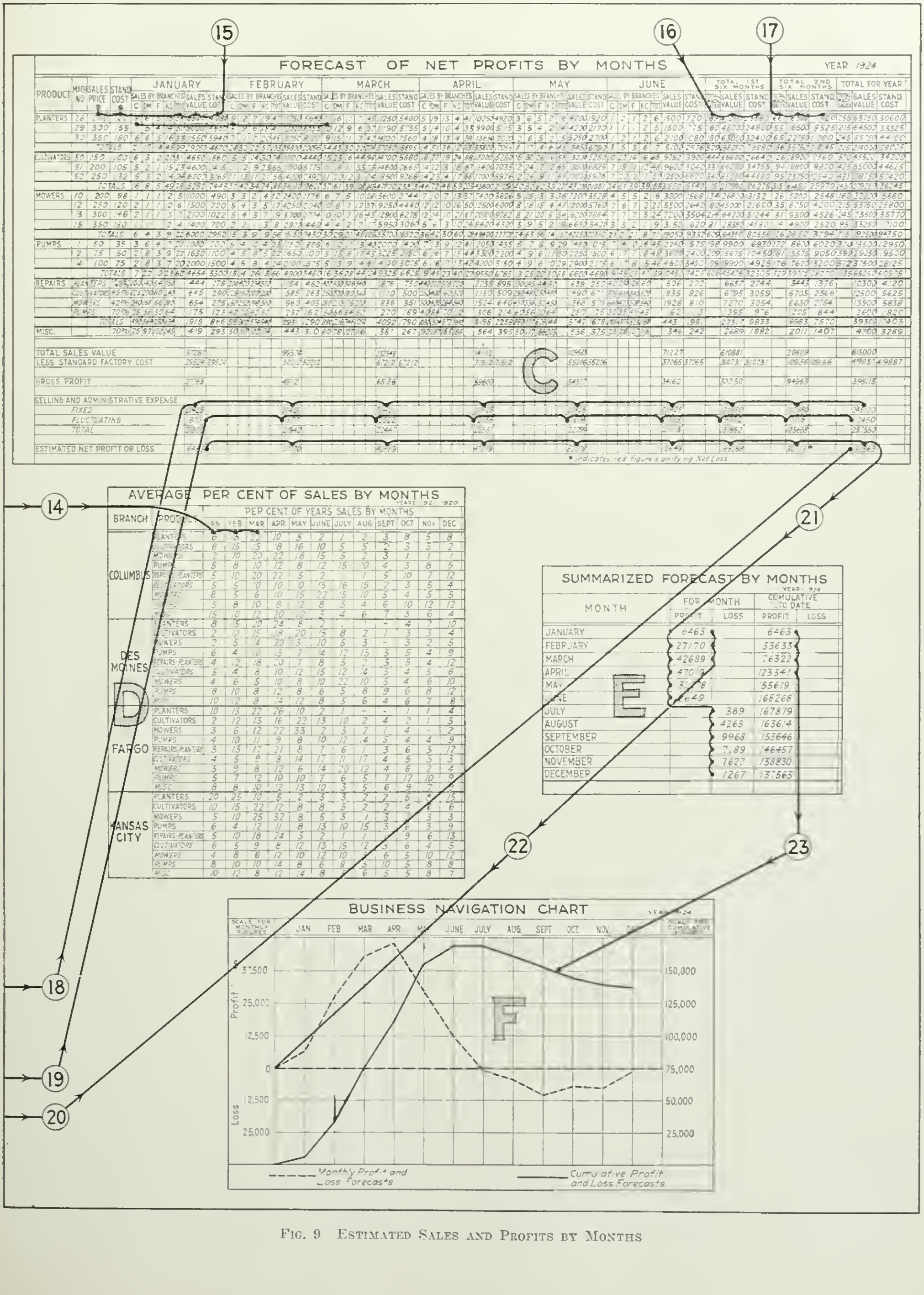
15
16
17
FORECAST OF NET PROFITS BY MONTHS
YEAR 1924
PRODUCT
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
TOTAL 1ST SIX MONTHS
TOTAL 2ND SIX MONTHS
TOTAL FOR YEAR
PLANTERS
CULTIVATORS
MOWERS
PUMPS
REPAIRS
MISC.
TOTAL SALES VALUE
LESS STANDARD FACTORY COST
GROSS PROFIT
SELLING AND ADMINISTRATIVE EXPENSE
FIXED
FLUCTUATING
TOTAL
ESTIMATED NET PROFIT OR LOSS
* indicates red figures signifying Net Loss
C
14
AVERAGE PER CENT OF SALES BY MONTHS
PER CENT OF YEARS SALES BY MONTHS
BRANCH
PRODUCT
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
COLUMBUS
DES MOINES
FARGO
KANSAS CITY
D
21
SUMMARIZED FORECAST BY MONTHS
YEAR 1924
MONTH
FOR MONTH
CUMULATIVE TO DATE
PROFIT
LOSS
JANUARY
FEBRUARY
MARCH
APRIL
MAY
JUNE
JULY
AUGUST
SEPTEMBER
OCTOBER
NOVEMBER
DECEMBER
E
22
23
18
19
20
BUSINESS NAVIGATION CHART
YEAR 1924
SCALE FOR MONTHLY FIGURES
SCALE FOR CUMULATIVE
JAN
FEB
MAR
APR
MAY
JUNE
JULY
AUG
SEPT
OCT
NOV
DEC
Profit
Loss
37,500
25,000
12,500
0
12,500
25,000
150,000
125,000
100,000
75,000
50,000
25,000
F
Monthly Profit and Loss Forecasts
Cumulative Profit and Loss Forecasts

FIG. 9 ESTIMATED SALES AND PROFITS BY MONTHS

> In his efforts to see ahead and to adjust his course to meet changing conditions the captain of industry will need the support of accountants whose methods are in accord with the times and it is along this line that the great opportunity as well as the responsibility of the comptroller lies.

It is only necessary to review the accounting literature of the last year to realize that the prophecy embodied in the quotation just given is well on the way to fulfilment.

So long as accounting was confined to retrospection there were distinct limitations to the responsibilities and opportunities of the comptroller; it needed no very great ability so to organize routine work that the necessary reports and statistics could be produced with clock-work regularity, and it must be admitted that the comptroller's duties presented no special appeal to men of the highest caliber. The new viewpoint of accounting is changing all this. In place of being merely a cog in a routine machine the accountant is becoming one of the most important constructive forces in industry and one of the prime factors contributing to the development of business along scientific lines. The comptroller of today, though not necessarily a mechanical or sales engineer, must be fully acquainted with the underlying principles of manufacturing and distribution. He holds a strategic position in the business organization; he is the one man best fitted to harmonize and control the efforts of all divisions of an industry.

In a previous article in this series I stated that one of the most important steps any manufacturer could take was to figure out the profit-making possibilities of his business. It always seems remarkable to me that so many manufacturers fail to understand fully the effect of fixed charges on the profits of their business. To determine the point of sales where the profits of a business vanish is a very simple matter, but not all manufacturers know this elementary fact about their business. The method of determining this point is illustrated in the chart shown in Fig. 6, the data on which this chart is based being as follows:

Factory Cost excluding Fixed Charges	50% of sales
Fixed Charges	$20,000 per annum
Expenses Varying with Sales:	
Salesmen's Salaries and Expenses	12%
Administrative and Selling Expenses	8%

To determine the point of vanishing profits it is necessary to figure the profit at three different sales volumes as shown in Table 2.

TABLE 2. STATEMENT SHOWING THE PROFIT AT THREE DIFFERENT SALES VOLUMES

Item	Sales $100,000	Sales $125,000	Sales $150,000
Fixed Charges	$20,000	$20,000	$20,000
Fluctuating Expenses:			
Factory Cost, 50%	50,000	62,500	75,000
Salesmen, 12%	12,000	15,000	18,000
Administrative, 8%	8,000	10,000	12,000
Total Expenses	90,000	107,500	125,000
Net Profit	10,000	17,500	25,000

These three points of profit are plotted on the chart as shown by the dots and the correctness of the calculations (but not of the basic data, of course) proved by it being possible to connect all three points in a straight line. Incidentally it may be mentioned that in preparing this chart it is really only necessary to figure the profits at two different sales volumes, the third point being the loss on a no-sales basis, this of course being the amount of the fixed charges, namely, $20,000. The point of sales where profits vanish as shown by the chart is slightly over $63,000.

Comparing the profit shown on sales of $100,000 and $125,000, respectively, it will be seen that an increase in sales of 25 per cent will result in an increase in profits of 80 per cent so that it will be obvious that under the conditions illustrated a considerable increase could be made in the percentage of fluctuating expenses to sales, if such were necessary to obtain the greater sales volume, and still realize an increase in the net profits.

In many cases, however, an increase in the sales will result in a far greater proportionate increase in the profits than in the case just considered. Table 3 represents an actual condition.

TABLE 3. INCREASE IN SALES AND PROFITS

Item	Sales $825,000	Sales $990,000
Cost of Sale plus Fluctuating Expenses	$728,000	$874,000
Fixed Charges	90,000	90,000
Total Expenses	818,000	964,000
Net Profit	7,000	26,000

The closer the sales are to the point of vanishing profits the greater the increase in profits as compared with the increase in sales. In the above case an increase in the sales of 20 per cent will result in an increase in the net profits of 170 per cent.

Now, of course, the problems of the comptroller in forecasting the results which may be anticipated from following a given line of action are far more complex than in the simple illustrations just given for the purpose of illustrating the general principles involved. A somewhat more complex problem is presented in the case when the sales manager approaches the comptroller and says: "I can increase my sales volume if I increase my sales force, but if I do this it means reducing the territory per man and the average sales per salesman will be reduced. Where is my point of diminishing returns—in other words, how far can I reduce my sales per salesman and still get an increased net profit?" The chart shown in Fig. 7 illustrates the method of approaching the problem. In this chart we are using the same basic figures as were used in preparing the chart shown in Fig. 6. It will be noted that in figuring the net profit of $25,000 on a volume of $150,000 sales the cost of salesmen's salaries and traveling expenses was placed at $18,000 and for the purpose of illustration we will assume that this represents a force of 6 salesmen averaging sales of $25,000 apiece and costing for salary and traveling expenses $3000 a year apiece. To determine the relative profit earned at varying total sales volumes and average sales per salesmen of $25,000, $20,000 and $15,000 involves the calculations shown in Table 4.

TABLE 4. STATEMENT SHOWING RELATIVE PROFIT EARNED AT VARYING TOTAL SALES VOLUMES

ITEM	SALES $125,000	SALES $150,000	SALES $175,000
Fixed Charges	$20,000	$20,000	$20,000
Fluctuating Charges excluding Cost of Salesmen:			
Factory Cost, 50%	62,500	75,000	87,500
Administrative, 8%	10,000	12,000	14,000
Total Expenses	92,500	107,000	121,500
Net Profit before Charging Salesmen's Expense	32,500	43,000	53,500
AVERAGE SALES PER SALESMAN, $25,000			
Number of Salesmen	5	6	7
Cost	$15,000	$18,600	$21,000
Net Profit	17,500	25,000	32,500
AVERAGE SALES PER SALESMAN, $20,000			
Number of Salesmen	6.25	7.5	8.75
Cost	$18,750	$22,500	$26,250
Net Profit	13,750	20,500	27,250
AVERAGE SALES PER SALESMAN, $15,000			
Salesmen	8.33	10	11.66
Cost	$25,000	$30,000	$35,000
Profit	7,500	13,000	18,500

The profit figures in Table 4 are plotted on the chart shown in Fig. 7 in the same manner as the profit figures were plotted on the previous chart. A consideration of this chart will then indicate to the sales manager his best line of action to follow to obtain the greatest net profits. For instance he may say: "I can increase my sales from $125,000 to $145,000 by restricting the territory per salesman and reducing my sales per salesman from $25,000 to $20,000 per man. Will this pay?" A glance at the chart will show that it will pay very handsomely.

The comptroller's work along these lines is largely a case of working out hypothetical cases. It is the sales manager's duty to figure, for instance, the extent of increased effort required to obtain an increased volume of sales; it is the comptroller's duty to tell him what the result will be, provided the sales manager has properly gaged the situation.

As stated earlier in this article, the new viewpoint of accounting involves the development of a complete new technique of accounting. It is no more possible properly to explain accounting technique without diagrams illustrating by actual figures every step involved than it is possible to give a proper understanding of the details of a machine by describing it in words. Figs. 8 and 9 are the first of a series illustrating the complete operation of a system to realize possible profits. Each operation illustrated is given a numbered line, explanatory notes regarding each operation being shown below under the caption of "Key to Numbered Lines on Figs. 8 and 9."

Taking the forms in sequence, the following is a brief general description of that portion of the plan illustrated by the diagrams given in Figs. 8 and 9.

The business taken for purposes of illustration in the diagrams is that of a manufacturer of miscellaneous agricultural implements. This class of business was chosen because it involves a number of special problems: first, it is very seasonal; and, second, it calls for numerous branch houses and its product comprises relatively large units, such as implements, and relatively small units in the form of repair parts, the latter being sold on a list basis.

It is assumed on Form A of Fig. 8 that, following the general lines discussed in last month's instalment of this series, a sales quota has been set for the Columbus Branch of $150,000 for the year 1924. It is left to the manager of this branch who is, or should be, in touch with local conditions, to split up this quota over the various articles to be sold. To assist him in making this distribution the head office fills in the information in the columns headed "Previous Sales 1923, 1922 and 1921." On the right-hand side of the form the manager sets the quotas for his individual salesmen and also forecasts his expenses, the head office having assisted him in this process by filling in the information shown on the form regarding the expenses of previous years. Before these estimates are incorporated on Form B they are approved by the sales manager.

On Form B, as its title indicates, the various branch forecasts are summarized. The summary shows not only the estimated profits of the branch as a whole but also the estimated profits on each class of machine sold by each branch and for the business as a whole. The gross profit estimates are obtained by deducting the standard cost of the estimated machine sales from their estimated sales value. The method of figuring these standard costs will be shown on the diagrams illustrating next month's instalment of this series.

On Fig. 9 the information shown on Form B of Fig. 8 is analyzed to show the estimated sales by months and the estimated profits by months. The estimated sales for the year as shown on the branch house forecasts are analyzed by months in accordance with the average per cent of the year's sales realized by the branches for each class of equipment in previous years. Full details regarding the method of using these ratios are given in the explanatory notes appearing below in connection with line 14.

On Form E the information shown on Form C is summarized to show the estimated profits by months individually and cumulatively.

Form F is based upon the information shown on Form E, the dotted line showing the estimated profit and loss in the individual months, and the solid line the accumulated estimated profit at the close of each month. As will be shown in succeeding instalments the actual profits are plotted on this chart as determined.

KEY TO NUMBERED LINES ON FIGS. 8 AND 9

1—Following the general lines laid down in the chapter on Sales Quotas (see MANAGEMENT AND ADMINISTRATION for November 1924, page 491) a quota of $150,000 sales has been set for the Columbus Branch.

2—In addition to showing the quota on Form A the head office has added information regarding the sales and the branch expenses in previous years.

3—On the basis of this information, coupled with his knowledge of conditions in his territory, the Columbus Branch manager divides his $150,000 quota by individual products.

4—He also apportions this quota to his salesmen.

5—And estimates his branch house expenses for the year.

6—The branch house forecasts are summarized at the head office on Form B, the detailed sales forecasts by products as shown on Form A being posted to Form B.

7—Extending the estimated number of machines to be sold at the standard cost gives the figures for the "Factory Cost" column (detailed information as to the figuring of standard costs is shown on succeeding diagrams).

8—The figures in the "Gross Profits" column represent the sales value figures less the factory (or standard) costs.

9—The estimated branch house expenses are posted from Form A to Form B.

10—The estimated general selling and administrative expenses for the year of $75,000 are prorated to the branches in proportion to their estimated sales.

11—Deducting the expenses of the branch from its gross profit gives the estimated profit for the year.

12—The estimated expenses chargeable to the branch are prorated to the sales of the different products in proportion to their sales value and the estimated net profit or loss for each product determined.

13—The sales, costs, and gross profit estimates for the different branches are totaled to give the figures for the business as a whole.

14—On Form C the estimated profit figures for the year as shown on Form B are analyzed by months. The first step in this process is to analyze the forecasts of the sales of each product by months. Form D shows the per cent of the year's sales of each class of product at each branch by months as determined from the sales records for previous years. The method of making this analysis is illustrated by line 14 as follows: The estimated sales of number 28 planters by the Columbus Branch for the year 1924 is 50 (see Form B). According to Form D, in the month of January the sales of planters in the Columbus Branch has averaged 16 per cent of the total planter sales of this branch for the year. Sixteen per cent of 50 is 8 machines, this number of machines therefore being posted to the "Columbus Sales" column for January on Form C as illustrated by line 14.

15—The total sales of number 28 planters for all branches figured as explained in the preceding paragraph is 34 and extending this quantity at the sales price of $250 and the standard cost of $120 respectively gives the figures for the "Sales Value" and "Standard Cost" columns of $8500 and $4080 as shown on Form C.

16—The figures for the first six months are totaled.

17—The figures for the second six months are posted from a detail sheet identical with Form C.

18—The fixed selling and administrative expenses of $245,100, as shown on Form B, are divided by 12 and posted to the monthly columns of Form C.

19—The salesmen's commissions of $12,450 as estimated on Form B, are split up by months in proportion to the estimated monthly sales.

20—The total estimated net profit for the year as shown on Form C must agree with the figure shown on Form B.

21—On Form E the figures obtained on Form C are summarized to show the estimated profit and loss by months individually and cumulatively.

22—The estimated monthly profit and loss figures are plotted on Form F by a dotted line.

23—The cumulative estimated profit figures are plotted on Form F by a solid line.

Handling and Storing Electric Meters

Index Number
621.3175 Electric meters

THE accuracy of meters in a power plant is a matter of prime importance. In the case of a public utility, meters are regarded as the pocketbook of the institution. Hence care in handling is necessary if they are to give correct readings.

A truck which has been developed especially for handling electric meters is shown in Fig. 1. This truck has rubber tires and is designed to carry the meters without jarring them and consequently throwing the delicate mechanism out of adjustment. The meters are slipped on hooks especially designed to fit over the edge of 2-in. angle irons. These angles are supported by pipes extending from the bed of the truck. Eighty meters at a time can be put on the truck.

An adjustable meter rack to hold meters in storage is also easily constructed of pipe and angles. Supports of 1¼- or 1½-in. pipe are set up, extending from floor to ceiling. Short pieces of 2-in. angle in the form of clips are fastened on these pipes by means of U-bolts. This method of attachment makes the clips adjustable at any height. To the clips are bolted cross pieces of 2-in. angle iron. Special hooks hung on these cross pieces hold the meters, and both sides of each rack can be utilized for storage. In the electrical repair shop and laboratory of the City of Los Angeles, where this rack and also the meter truck are used, 12 angle irons are mounted as cross pieces on each rack.

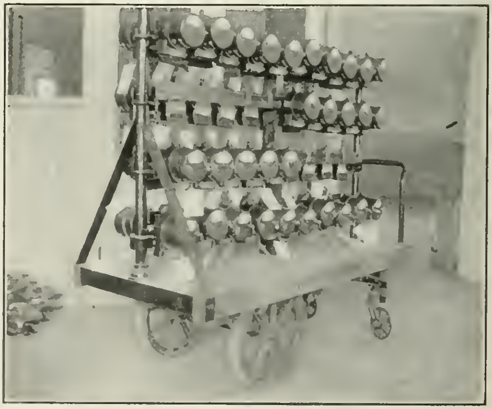

Fig. 1 Truck for Handling Electric Meters

Practical Points on Labor Policy

Work of the Industrial Executive

By B. A. FRANKLIN

Vice-President, Strathmore Paper Company

Index Number
658.3 Personnel management

THERE are few problems in industry, if any, which should be of more constant consideration than that of labor, not only on the broad score of the general welfare and happiness of humanity, which is the basic reason for the existence of industry, but also because nothing makes for such satisfaction, or such ease and economy of operation to the individual management, as reasonably satisfied and loyal labor.[1]

It ought to be the natural, as it is the logical and agreeable condition that management and labor should be found in reasonable accord. The main difficulty is that not only is there, in so many cases, no common understanding, but indeed no particular effort to bring it about. This is an executive weakness, for labor is a vital element of industry.

There are certain points of view which may be developed as fundamental to the proper understanding of the labor situation. A basic point of view is that which comprehends industry, next to government, as the greatest service in our modern civilization. This becomes the basis of a practical idealism, and may well become the basis of practical operation if the three parties to it—capital, management, and labor—shall come to an understanding of their proper relations to it and to each other. Since each of the three renders a part of the service, the question of reward for each has naturally, because of human nature, become the point of disagreement.

For the best industrial results, friendly relations and real co-operation between employer and employee are essential. Yet labor troubles are constantly arising and even when there are no active differences between capital and those it employs, discontent and restlessness among the men too often stand in the way of really effective production. Mr. Franklin touches upon the reasons for antagonism between employer and employee, describes the relations that should exist between these two and the public they mutually serve and suggests methods for bringing about these relations

This disagreement is the basis of the struggle between capital and labor. It has brought about unionism of labor in its endeavor to make a stronger fight for what it believes to be its share. Increasing progress towards the understanding of human rights, aided by increasing wealth in America, has done much for our industrial workers.

Unionism has unquestionably aided labor in its fight, but it has also made many burdensome inequalities, because it has not grasped its full opportunities. In proclaiming its rights it has neglected its duties, for if it is the right of labor to get a larger and larger portion, it follows that it is also its duty to produce a larger and larger amount.

Here is a definite opportunity and task for the industrial executive. He feels, naturally, that he must operate in an open shop because he must manage independently if he is to manage successfully. Unionism gives him no support in management. To date it only attempts to give him orders.

This question of reward becomes, then, a matter of importance, to be reasonably understood by the industrial executive who has to deal with the service reward of labor.

It is logical, of course, that service shall be paid in proportion to its value. It is established practice therefore that the return to so-called common or unskilled labor shall be the smallest, both because it is performed with the least call upon acquired resources, and because it is the most plentiful. But it is to be noted that with the partial cessation of immigration the law of supply and demand has raised the rate of pay for unskilled labor considerably. There follows, then, in order, an increase in the rates paid to the semi-skilled, the skilled, to the lesser executive, and to creative efforts, management and capital, because they offer in about the stated order the greater call on acquired resources and are more difficult to secure.

The difficulty of the situation lies in the fact that no one has developed a method, or been accepted as an authority, to determine practically the minimum reward of common labor, the relation of the rewards to different classes of labor, the different values to different skilled operations, or even the rewards that should be given to the higher grades.

The wise executive will always want to make wages as high as possible, as far above the minimum, so-called living wage as he can, for this means more satisfied and capable labor. Labor will, however, always want more whatever it gets, for that is human nature.

Nevertheless, there are sufficient gages, varying in localities and with the times, on which the industrial executive can operate. But he can best operate with some understanding of the real desires of labor.

What labor really wants is a steady job, fair treatment, and the feeling that it is part of the game. These things really make for its happiness, for the average laborer is the average human being. This is the important starting point on which developments depend.

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[1] For preceding articles see MANAGEMENT AND ADMINISTRATION for September 1924, p. 249; October 1924, p. 391; November 1924, p. 513.

The economic urge, the necessity to live, the desire to maintain at least the ordinary standard of living, the dependence of family, are powerful motives operating with labor.

Yet these are not entirely sufficient. At a recent conference of a dozen large concerns representing different industries in a medium-size city—all successful concerns with well-paid labor according to the present standards—a comparison showed that the yearly turnover figured by dividing the total number of employees into the total changes for all reasons was from 60 to 113 per cent. This does not mean that a majority of the employees shifted, for the changes occurred in a small per cent of the positions. Any concern that keeps its statistics on this point will discover a large turnover if it is in a reasonably large city.

This turnover causes, during a year, a very definite loss to every individual industrial unit, and offers to the industrial executive through the adoption of a reasonable method of selection a very appreciable saving, especially if there shall be added a service reward to keep workers in steady employment. Long service unquestionably means definitely better quality and quantity of production. One company has met this problem by adding 2 cents an hour to the standard wage of its employees at stated intervals of lengthening service after an initial number of years. And this is not entirely ineffective. But the truth is that wage alone is not sufficient incentive to make loyal and energetic labor.

The Attitude of Labor

There has been a general belief that labor was a commodity which could be bought with money—wages—just as other commodities are bought with money. This belief has been resented by labor, which finds itself thus put in the class with machinery. It is a theory consistent only with that which makes the industrial unit a feudal fief and gives ownership and management feudal rights, if wage conditions are met. It is entirely inconsistent with the idea of industry as a center both for the making of articles to supply the public and as a service center for its employees.

Now there is nothing socialistic in this latter theory. There is nothing inconsistent with private ownership in it. The law in effect recognizes both the service center idea and private ownership in that, on the one hand, it insists on certain minimum health and safety regulations, compensation returns, working conditions of at least given standards, guards, and escapes against fire hazards, and various protective methods in the interest of the worker, and in some cases a minimum wage, while recognizing all the essential rights of private property. It is important, therefore, that the industrial executive, if he is to operate satisfactorily with his labor, should regard industry as a service externally and internally.

The worker is a human being with all the ambitions, desires, sentiments, ignorances, oppositions, and acquiescences of the average human being. He wants all the wages he can get, but under ordinary conditions contents himself with the standard of the locality, which varies all over the United States.

In the small towns and villages where life is simple, where the social life is less stratified and the temptation to spend is less, the worker is content with comparatively small wages, but obtains by the very nature of village life that relative share in the game, and a place in affairs, which is apt to be denied him in a large, crowded city with closely packed dwellings or tenements.

Some large companies have seriously considered, where it seems possible, the confinement of their manufacturing to the small villages, and a division of their plants to gain these advantages, which mean cheaper production as well.

The Continuous Employment Plan

If the wage incentive alone is not sufficient to secure contented, capable service, what may the industrial executive offer?

Among the larger possibilities is the continuous employment guarantee. This plan offers a long step forward and requires considerable calculation and courage. A practical method seems to be a guarantee, on the part of the industrial unit, that it will employ those of its workers who have been with it, say for 5 years continuously, for at least 48 weeks at the agreed-upon rate of pay. The company reserves the right of discharge just as the worker reserves the right to quit, but the unit naturally reserves the right to employ the worker at whatever job may have to be done in case the regular operation is not necessary. Also the industrial unit reserves the right on stated notice to abrogate the plan.

One large company in Cincinnati has put into effect such a plan, and in New England there is a company which has been operating thus for several years, its employees being tied up by personal contracts which do not compel them to forego unionism if they desire it. There was recently in the trade to which this unit belongs, a strike, but the employees of this company did not join in it. The executives estimate that any losses they have made in presumably lost wages through the guarantee have been made up by their saving in the strike.

Stock Ownership for the Worker

Another major matter in the interests of labor rests in stock ownership. In the mind of labor the great difference between the capitalist and the worker is this question of ownership. No matter by what long process of thrift, courage to risk, energy, hard work, and ability this ownership has been obtained, or from what station the capitalist has risen, he stands differentiated, in his fellow workers' viewpoint, by stock ownership. Since industry is very distinctly a co-operative proposition, there is no fundamental reason why its ownership should not be mutual as to all co-operators who are willing to meet the necessities. Under the proper arrangement there are very good reasons why it may be mutual with very beneficial results.

The ordinary man will work with maximum ability and energy for himself. He will work between fixed hours with reasonable interest for another. He can understand and will comprehend actions in his own interest. He is suspicious of ownership where he has not a part in it. He is jealous of a profit when he shares in it. He is careless of it when it belongs entirely to another. He is "exploited" when ownership seems to be largely benefited by profit in comparison to his income. He is "part of the game" when, as a shareholder, he gets a part of the profit.

Now the worker generally has very little comprehension as to stock ownership and how it is handled or obtained. When he does understand it, as is frequently the case in America, he becomes a stockholder of his own making. It is generally advisable, therefore, on the part of the industrial executive who sees the value of such a plan, to devise one that will protect the doubtful purchaser. One concern in Massachusetts issues an employees' preferred stock in shares of small par value but with cumulative dividends, on the service basis, of from 7 to 12 per cent. In addition it issues, at par, to selected employees, its regular common stock.

The Industrial Conference Board has collected the data of very many industrial units operating on an employees' stockholding plan. Such a plan has infinitely more vitality than mere profit sharing. Some concerns have thought so much of the value of this plan that they have introduced various bonus schemes by which they contribute part of the purchase price. In all such methods separation of employment involves repurchase of stock by the concern.

The Bonus Idea

There is one other group of methods which offers to labor a source of added income—a matter which is the most persistent desire of every earner of money, rich or poor, for after all either with capital, management, or labor the dominant incentive is an increasable income. That group is the oldest and most common of the incentive plans to labor and involves all of those methods which offers bonuses of some nature for either quantity or quality above a rated standard or both.

This last group—that of the bonuses—is the most grateful to labor as an immediate relief, because its reward comes in the weekly payroll and has a direct and understandable relation to effort. Despite this, statistics show that only some 44 per cent of industrial labor in America is given this opportunity. And yet every industrial executive who wants the maximum efficiency from his labor ought to understand the standard methods of extra incentive and their particular application under varying conditions. No matter how labor may look upon various and sundry other schemes of reward, it can understand and will operate upon, when unionism does not prevent, a scheme which offers it more pay for more work, and as a principle it is fair and practical for both labor and management. Under whatever method the industrial executive operates, if he has both his responsibility and his workers' welfare at heart, he will give thorough consideration to all extra incentive plans.

Welfare Work

Certainly a kindly theory, reasonably a sound and fair one, and undoubtedly an effective one, on which the industrial executive may operate in relation to his workers and their welfare, is that which is based on two considerations. The first is that the worker who casts in his lot with the industrial unit for life, or for a reasonable time, may be entitled to such reasonable assistance as his circumstances may not have permitted him to obtain for himself. The second is that the industrial unit with its experience, financial ability, broader aspect, and executive abilities possesses ready means with little difficulty or expense, to do things for its employees once its desire is aroused. Since the carefree and happy worker is the more efficient worker, provided of course his sense of responsibility has been developed, actions put forward in the interest of the worker are profitable.

Nearly all plans put forward by the industrial executive should, however, bear in mind one consideration, and that is that the operation of these should be in the hands of the employees. No matter what may be the viewpoint of management or capital the worker, especially in America, considers himself a free and independent agent, able to handle his own affairs. He resents paternalism. Whatever he may get in return for his labor he considers it his due, and reacts towards it very much more loyally and generously when it is rendered as a natural act of the service center, even though he may not demand it as a right. Moreover, the operation of such schemes under the management of his own selection develops the organization idea in his mind and this breeds loyalty. It makes him feel he is a part of the game.

A rather common and increasingly growing benefit is the introduction of insurance for employees under the modern group insurance plan. This is best accomplished through the organization of a beneficial association operated by a board elected by the employees annually. One company in Massachusetts has such an association where the worker, for 5 cents a week and $1 a month, obtains $10 a week sick benefit, $1000 life insurance, and a yearly confidential health examination by the Life Extension Institute, the company paying into the beneficial association treasury all fines, personal telephone charges, and in addition duplicating, dollar for dollar, all contributions of employees. Care is taken that in this, as in all such plans, everyone from the president to the latest arrival has the same rights, privileges, and expenses. It is a thoroughly co-operative plan in which everyone with the company co-operates and receives the same advantages.

Being very much of a human being the worker has ideas. Scientific management teaches that the collected ideas of an industrial group may exceed the knowledge of management. At any rate the worker, in his desire to be a part of the game, likes to express his ideas, to see his schemes, if good, in action. The wise industrial executive makes for him an opportunity in the suggestion system. The ordinary box method does not allure the worker who cannot express himself and it is apt to die quickly. One company has instituted a method, over many years, of sending around monthly to all its employees a clerk, who inquires of everyone if he has any suggestions and writes them down. These suggestions go before a board, which includes the engineering head. They may refer to comfort, safety, or improvement leading to economy, and in the latter case have been rewarded in sums varying from a minimum of $5 up to $200. Each suggestion is answered in writing. From the point of view of safety, of employee satisfaction, or of economy, such a plan is well worth while.

Many industrial units operating on the basis that its employees want to know the news and gossip of the center, publish monthly papers, preferably written by the employees themselves.

Most workers, sometimes by fault of circumstances and opportunity, most frequently by desire, go a very little distance in the way of education. Their knowledge of economics and its laws, which of course are fundamentally at the base of industry and government, are very limited, although in this they are not always very far behind many of their employers. Their ideas of the methods of management are vague, and therefore readily opposed to new introductions. The industrial executive will make no mistake for his unit in offering them an opportunity of understanding the methods and laws which control and improve industry.

A company in Ohio and one in Connecticut, among others, have undertaken to make clear the simple economics of industry. In Massachusetts there is a company which pays the fee of any of its employees in any correspondence course or any night-taught course, paying the fee in advance, taking it out of the pay envelope of the student weekly, and returning it in full on a presented record of fair attendance and passage of examinations, the student thus getting the advantage of the course, invariably to the betterment of his work and loyalty, and a saving of the fee in full. Among several hundred students over a period of 5 years there is a record of only two failures. This company also has a class of 50, taught from textbooks in the technical side of its industry.

Advisory Assistance—Thrift Plans

Workers need advice of all kinds which their lack of initiative and natural ignorance of legal, health, and other matters lead them often to do without, to their detriment. Their loss of health or worriment of mind react in their work-efficiency. Many concerns in their own interest supply this deficiency. One concern in Boston employs two dentists, a doctor, a lawyer, and of course nurses, regularly, and believes it pays them well. They give advice and help in home-buying and in all affairs on which advice is asked. This is all offered voluntarily and without charge. It is part of the return for efficient work.

An important element both in the lives of workers and in the matter of their stability, is that they will be helped in the matter of thrift, and in gaining for themselves a home of their own. The man with a stake has a basis of energetic ambition. He becomes not only a good worker but a good citizen. One company in the Middle West makes it a matter of definite policy to help its men in saving and in buying a home. While the Ford idea of social inspection can never be popular in this country it undoubtedly was of real, if forced, value to his workers.

The Works Council

One more very important interest in dealing with labor must more and more in the future have deep and active consideration, and this is the works council. During the last decade the question of unionism or the open shop has been demanding greater attention. No matter what may be the rights of labor to join in unions and the unions to operate in their interest, if there is to be peace with economy certainly the present plan of operation, as illustrated for example by the building trades, in railroad labor customs, and other like instances, cannot continue to prevail any more than many of the harsh measures formerly operated under capital were continuously bearable. Management must manage independently, and should, if it manages well. Labor must work efficiently and with discipline, and then deserves the fairest treatment.

It is merely a matter of human nature that labor, being human, in a democratic country wants a say in its treatment. If it is to co-operate in a service center it wants a definite part in the game. The works council, elected by labor, in the industrial unit, with prescribed functions, offers a way out for both labor and management.

The works council must, however, operate on a very simple basis. The idea of legislative design once broadly bruited is not likely to live. It is too complicated and slow-moving. A simple committee, departmentally representative, periodically elected, conferring regularly with management, will be found in the long run very effective. A meeting between these two elements, with all the cards on the table, can solve nearly any mutual problem, not only in the interest of labor, but in the interest of the industrial unit. There is enough conservatism and common sense in labor as well as in management to guarantee this if the plan is followed.

Conclusion

Management desires to control, to direct, to inspect, to speed labor. It must then assist, educate, train, and reward it. In seeking the maximum peaceful return it must accept the maximum responsibility.

Labor, being human, will respond in the end to the service center idea when broadly operated, for American labor is probably the most intelligent, as it is the best paid and best treated labor in the world. If the industrial executive will then consider and approach the human side of labor with practical and well-adapted methods, labor in the end will, as it must, find content and happiness in work and in living.

Proficiency Tests for Stenographers

By EUGENE J. BENGE

Office Personnel Manager, The Atlantic Refining Company

THE average business man is at the mercy of his stenographer. When she stays out because of the lobster and ice-cream the night before, he realizes fully his dependence upon her.

But it is not only in her absence that his dependence is shown. Day in and day out the letters which she writes are speaking eloquently for or against his business acumen; the misfiled letters are causing the furrowed brow of vexation; the mispelled words are bringing smiles of amusement to the recipients.

Every business man, whether he be a department head in a large corporation, or whether he be the head of a company of one, requires a good capable stenographer. How to find her is the question.

The usual method he follows is to dictate a letter ex tempore or to read off any letter which happens to be on his desk at the moment. Either of these ways is unscientific and should not be used. Especially should the use of letters involving technical terms or phrases be avoided.

It is quite feasible to devise a test for stenographers which will weed out the incompetent applicants and leave the employer free to choose from the qualified candidates the one whose personal qualities seem most desirable. By following the procedure outlined in this article, a satisfactory stenographic test can be devised, and yet be individualistic enough to meet the varying requirements of different business concerns.

In giving such a test every effort should be made to relieve the applicant of any nervousness which might influence the quantity or quality of her work.

Analysis of Stenographic Ability

The first step is to study the job or jobs which are to be filled. An analysis of two positions might reveal the following ratios of time distribution:

Nature of Work	*Per Cent of Time Consumed* Position A	Position B
Takes dictation	10	20
Transcribes	40	70
Types from copy	30	..
Files	10	..
Miscellaneous	10	10
Total	100	100

If desired, each position can be studied to determine the importance of various elements. These varying weightings can then be taken into account when considering a test result. It is obvious that Position A requires more versatility than Position B.

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658.31156 Selecting workers.
Tests

Spelling. Since spelling is a basic requirement for a stenographer, the applicant should be given some type of spelling test. It is best to select from the files words which have been most frequently misspelled, but the following list can be used:

1. decision
2. preliminary
3. convenient
4. emergency
5. extreme
6. character
7. testimony
8. evidence
9. association
10. height
11. earliest
12. colonies
13. relief
14. probably
15. recommend
16. especially
17. committee
18. sincerely
19. proceed
20. February
21. arrangement
22. session
23. distinguish
24. expense
25. beginning
26. difficulty
27. finally
28. circumstance
29. mere
30. material
31. agreement
32. receive
33. citizen
34. majority
35. divide
36. circular
37. summon
38. volume
39. accident
40. victim
41. accept
42. concern
43. automobile
44. decide
45. political
46. resent
47. refer
48. ought
49. conference
50. really

The above list has been adapted from a comprehensive investigation of business words most frequently misspelled. It can be dictated to the applicant, one word at a time, to check her accuracy. Or, a list can be handed the applicant, in which half of the words are incorrectly spelled. Simply say to her, "Check off the incorrectly spelled words in the list". If this latter procedure is accomplished, the following table of comparison can be used:

Errors	*Percentage of Stenographers Whom Applicant Exceeds*
0	93 to 100 per cent
1	79 per cent
2	67 per cent
3	57 per cent
4	48 per cent
5	39 per cent
6	30 per cent
7	21 per cent
8	14 per cent
9	9 per cent
10 or more	9 per cent

Dictation. A letter of 200 words in length should be carefully prepared. This letter should be typical of the letters which the applicant would receive as an employee, but should not contain technical terms nor phrases.

The letter should be dictated to the applicant at a speed which slightly taxes her ability to take it. In other words, the dictator should keep a little ahead of the stenographer rather than wait for her to catch up with what he has said. The practice of dictating to all applicants at a standard rate of speed should be avoided. All punctuation marks should be dictated.

Time the dictation. Inasmuch as there are 200 words in the letter it is a simple process to compute the dictation rate per minute. For example, if the applicant took down the letter in two minutes and a half, the rate of speed would obviously be 80 words per minute.

In order that results may be comparable, it is absolutely essential that the same letter and the same spelling list be given to every applicant.

Transcription. Make certain that the stenographer is familiar with the machine on which she is to transcribe the letter. If necessary, allow her to practice with it a few minutes, although care should be taken that she does not use her own notes for this purpose.

It is a desirable procedure to give the spelling test previously mentioned immediately after the dictation. This distracts her mind from the letter and causes her to lose much of her memory element, so that her transcription will be almost entirely from notes, and not from memory.

Record the time that the stenographer requires to transcribe her notes and calculate the rate per minute. Tell her not to erase any errors. If she pauses more than a few seconds over a particular outline, say: "If you can't make out any particular part, just leave space and go on".

On the transcription, check off the errors and total them. The following should be counted as errors:

1. Words, letters, or punctuation marks omitted.
2. Letters struck over, or erased in disobedience of direction.
3. Spacing omitted between words.
4. Extra words, letters, or punctuation marks inserted are *not* counted as errors.

Typing. The same letter can be used for applicants for the position of typist, using a perfect typewritten specimen for copy. Errors should be summarized in the same way.

Test of Proficiency in Filing

If filing is an integral part of the stenographer's task, a simple test of filing should be administered. One hundred 3 x 5 in. cards should be typed with various names and addresses in different states. Direct the applicant to arrange the cards in proper alphabetical order, and check her arrangement. Then ask her to classify the cards by states and arrange in alphabetical order within each state. Again check her arrangement.

To simplify this checking of the two filing arrangements, a code of letters or numbers can be placed on the back of the cards. Such code should not be so simple that the candidate will comprehend it and file the cards according to the code, disregarding the names and addresses. The following will be found to be quite practicable:

Use a number, the first digit of which is misleading. For example, the backs of the first ten cards in correct order can read 41, 72, 83, 24, 65, 76, 97, 28, 89, 510, etc. In these the first digit should be ignored entirely. This system or some modification of it can well be used for both codes.

The score for this simple filing test is calculated by totaling the errors. An error constitutes a card missing from its proper place. This same card, inserted at some other place is not counted as wrong, because the applicant would then be penalized twice for the same mistake.

Comparing the Test Results

Let us assume that we are attempting to fill Position A, previously analyzed. Our analysis gave the ratio of time distribution as:

Takes dictation	10 per cent
Transcribes	40 per cent
Types from copy	30 per cent
Files	10 per cent
Miscellaneous	10 per cent

The records of three applicants for this position are given below. Note how easy it is to decide which one is better qualified for the vacancy as far as the test results are concerned.

APPLICANT	DICTATION SPEED PER MINUTE	TRANS'N SPEED PER MINUTE	ERRORS IN TRANS'N	ERRORS IN SPELLING	ERRORS IN FILING
Stenographer X. .	86	24	3	2	5
Stenographer Y. .	85	34	1	0	1
Stenographer Z. .	95	32	8	4	5

Obviously applicant Y is more proficient than either of the other two, according to the test results.

Although the test procedure which is outlined in this article is not the most scientific which could be devised, yet it is simple to comprehend and carry out. That it will yield valuable results in pointing out the incompetents and in indicating applicants with good stenographic ability has been proved by actual trial.

In order to obtain results that are fairly indicative of the applicants' ability under normal conditions it will be necessary to put them at ease. A test conducted in a hurried, impersonal manner causing the applicant to worry that he will have no job if he does not pass, may be a test of temperament, but it is not a fair test of stenographic ability.

Present and Future Power Equipment

Comparison of Prime-Movers, Boilers, and Requirements in Auxiliaries

By HUBERT E. COLLINS

Mechanical Engineer

VISIONS of new sources of power have been numerous during the last three decades. Many of the new suggestions seemed good from the viewpoint of adaptability and economy, so much so at first, that the newcomer was expected to supplant many old-timers. As time has flown, and the old-timers have held their ground, and results have been checked up, we find that the new and the old each has its own field where it can make good. It is not alone a case of deciding which type of prime-mover is the best for general application, but which is best for individual power plant needs. First cost, operating cost, and all items entering into the cost of a delivered horsepower while supplying *all* the needs of the plant, make the decision of the proper prime-movers an almost individual study.

The general public has felt that if only the cause hindering the development of our available hydroelectric power could be eliminated, "white-coal" would supply all our power needs at minimum cost. Aside from all the arguments of purchase of power rights, high cost of development, etc., which enter into this phase of power source, the United States Geological Survey has completed a study this year, which tells us where we are, and another vision stands revealed as not being the "surcease for our sorrows".

After a careful study of the reports of its engineers, and a tabulation of existing developments, it is estimated that the potential waterpower of the country, available 90 per cent of the time, totals 34,818,000 hp., of which 9,087,025 hp. has been developed at the present time. Taking these basic figures, the *Electrical World* has segregated the developed waterpower into that developed by central-station companies and that developed by industrial companies. Drawing upon a study of the future growth of the industry for the next 10 years, and assuming that the total industrial waterpower developments will remain constant, we quote from this report as follows:

> Looking first at the country as a whole and even assuming the impossible—that all potential waterpower could be developed by 1927 and tied into a national network—it appears that all the potential waterpower available 90 per cent of the time would not alone supply the needs of the central-station industry after 1927. In other words, with hydroelectricity used to the utmost theoretically possible, all future growth after 1927 would be steam growth, and it would be only a few years, about 1931, till the steam-plant rating would be equal to the present rating—*and still growing.*[1]

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> The potential waterpowers available for central-station development total 32,860,000 hp., and the total rating of the central-stations of the country will pass this available power figure during the year 1926. By 1933 the rating of the central generating plants of the country will exceed the total maximum potential waterpower available for central-station development by 26,640,000 hp. Thus by 1933, if all the waterpowers of the country, available 90 per cent of the time, and available for central-station development, were developed, there would remain fuel-burning generating plants with a rating approximately equal to the total maximum potential waterpowers of the country.

This analysis shows that with waterpower development proceeding as rapidly as possible, the steam-electric station will still be the most important single factor in the supply of central-station service and in the industrial-company field as well. Gone, then, is the vision of "white coal" being supreme, with the steam prime-mover manufacturer out of business.

The term "super-station" has taken hold of the public mind as applying to hydroelectric, or "mouth-of-mine-fuel-burning steam-electric" stations, or a combination of the two, until the compound word might well be *superstition.*

In the case of the mouth-of-mine-fuel-burning-electric there is a curious anomaly in the fact that the most economical steam-electric plant will require so much condensing water that so far as its availability is concerned, the plant might as well be hydroelectric. To be more specific, mouth-of-mine plants cannot be placed in every mining district because of the lack of water, and so too much stress cannot be laid on this type of plant as a "cure all" for our power ills.

We must realize the truth that at present we have available power from hydroelectric, steam-electric, including mouth-of-mine, and internal-combustion-electric (oil and gas engines), any of which may fit our industrial requirement for power. These three general classifications of prime-movers may be, one or all, grouped in super-power centers or in isolated plants. The super-power idea is one great development that is here to stay and merge into reality. The well-designed prime-mover of 30 years ago is still making a place for itself even if we did at one time fear for it with the turbine looming up in the distance. So it will be with the super-power station against the private plant. The adherents of each may rest assured that they will have plenty to do in keeping abreast of the other—with the cost of a delivered horsepower running neck and neck most of the time and in most localities.

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[1] The italics are ours.

Until some new, radical source of power not now known shall come to change the situation, steam and hydroelectric, both, will have part in serving our wants, with the former taking the lead, hydroelectric second, and internal-combustion engines in third position. To fit our special need, we therefore have to choose from some one of the following subdivisions of the three general classes of prime-movers.

PRIME-MOVERS

1. Steam Engines.	High-Speed	Single-cylinder. Compound.[1]
	Corliss	Single-cylinder. Compound.[1]
	Una-Flow	Single-cylinder. Compound.[1]
	Turbines	Reaction.[2] Impulse.[2]
2. Water-Wheels		Direct.[3] Hydroelectric.
3. Internal-Combustion Engines.	Oil	Direct.[3] Oil-Electric.
	Gas	Direct.[3] Gas-Electric.
	Producer-Gas	Direct.[3] Producer-Gas-Electric.

[1] Two-cylinder

[2] Explained in detail under "Turbines."

[3] Means direct from shaft by gear or pulley wheel and belt. The High-Speed, Corliss, or Una-flow, of one- and two-cylinders, or Turbine engines of any number of stages, can be direct in this sense or attached to the generator from which power is transmitted

High-Speed and Corliss Engines

The greater number of these are single-cylinder, with single valves, but the number of valves ranges up to four on some single- and double-cylinder engines. Valves include D-slide, Balanced Slide, Balanced Piston and Poppet. Up-to-date, high-speed engines have been best at pressures of not over 125 lb. gage at the throttle.

Many operators have doubted the adaptability of this type of engine to keep in line with increasing pressures and temperatures, but it is safe to predict that before long, these units will be operating at pressures and temperatures not yet attempted. To do so will eliminate valves other than the piston and poppet types. The advantages will be reliability, simplicity of design, manufacture and repair, low maintenance costs, minimum lubrication, and large port openings obtainable. We may therefore expect this type of engine to remain with us for some time to come as the main units in many manufacturing plants, hotels, hospitals, etc., and as auxiliaries in the larger stations.

The range of economy for high-speed, single-cylinder engines is 33 to 45 lb. of steam per indicated hp. hr., for two-cylinder non-condensing 27 to 31 lb., and for condensing units, with two cylinders, 23 to 27 lb.

The feature of the Corliss type is four valves with automatic releasing gear, controlled by fly-ball governors. They are slow- or medium-speed, and for this reason the maintenance costs are low, while the relative economy is better than the high-speed engines.

Single-cylinder engines use from 26 to 33 lb. of steam per indicated hp. hr., two-cylinder non-condensing will use 23 to 28 lb., and condensing, 20 to 25 lb., somewhat better than the high-speed type.

Una-Flow Engines

The primary claim for the single-cylinder engine is greater economy in use of steam while using exhaust for heat or process work. The claim is good when exhaust pressures do not exceed 10 lb., but as process work in most industrial plants calls for 17 to 25 lb., the result is that these units are best in hotels and hospitals. Industrial plants use them only where exhaust steam is required for heating in sufficient quantities to warrant a full load for the unit during the heating season, it being operated condensing during the warm months.

It is clearly established that these units are most economical where the exhaust pressure is not over 10 lb. gage.

The main talking point in the sale of this class unit is greater economy in use of steam than with the old types of high-speed and Corliss engines, and this is true only within the above limitations. In respect to maintenance costs, the una-flow has no lead unless designed with longer cranks and slower rotative speeds.

The steam consumption of single-cylinder una-flow units ranges from 26 to 30 lb. of steam per indicated hp. hr. when running non-condensing.

Steam Turbines

In central stations the turbine is replacing the reciprocating engine, and there is really no argument as to which is best for that field, aside from the auxiliary units.

The turbine has also been used extensively in industrial plants, but it is the opinion of many engineers that, in many places, a careful study was not made of the adaptability of the unit for the special plant. Such installations are due to a lack of knowledge of their advantages and disadvantages and of the class of service to which the different types of turbines are best adapted.

The impulse turbine has the advantage of additional steam nozzles or groups of nozzles, in addition to the throttle, by means of which the flow of steam can be controlled and expansive force of the steam used on light loads. The majority of impulse turbines are so equipped. In the reaction turbine the initial pressure is reduced at the throttle generally, so that the turbine is working on reduced initial pressure on light loads. The impulse design has greater radial clearance for the turbine rotor and is ordinarily less affected by slugs of water scale and chips, or dirt carried over with the steam.

At full loads, the two types have about the same steam rates, with the impulse type equipped with nozzles, leading in economy with light loads. Most all small steam turbines for driving auxiliary units are of the impulse type with only one wheel and one, two, or three rows of buckets and a throttling governor.

As a prime-mover, the advantages of the steam turbine are: minimum space required both in floor area and height; lighter weight permitting smaller, lighter, and cheaper foundations; minimum adjustment in the machine, giving long and continuous service; no internal lubrication; and elimination of oil in the exhaust steam or condensate. The disadvantages of the small steam turbines are high steam rates and high speeds for direct connection to direct-current generators or shafts. All turbines are condensing units also, if the economy they are built for is to be attained. As non-condensing units they are more extravagant in the use of steam than are the worst single-cylinder, high-speed engines running high pressure.

The range of economy for impulse and reaction turbines running non-condensing is from 31 lb. of steam per indicated hp. hr. at 100 per cent load to 42 lb. for "nozzle governed," and 46 lb. for "throttle governed," while the single stage units range from 40 to 80 lb. A well-regulated turbine operating condensing should use 14 to 15 lb. of steam per indicated hp. hr.

Bleeder Extraction Turbines

These are primarily designed to compete in the industrial plant field with high-speed, Corliss, and una-flow reciprocating engines. They are designed to meet the demand for a combination back-pressure and condensing machine that will permit the bleeding of steam at a predetermined pressure for manufacturing purposes, processes, heating, etc., and maintain a balanced condition throughout any variation or interruption of either power demand or steam drawn from the bleeder section of the machine. While the principle is ideal, the machines sometimes have not lived up to their possibilities, owing to their not being correctly proportioned to the service demanded.

To design a bleeder turbine for highly economical results, the special requirements of the specific plant should be considered. As the steam bled is fixed by the mill demand, the turbine should be so proportioned that the amount of steam going to the condenser will be as small as possible.

As to the steam consumption of these machines, if they are not properly designed for the exact requirements, they may well run into the maximum of 40 to 80 lb. per indicated hp. and even when properly designed will not consume much less than 31 to 42 lb. at best.

There is no argument as to turbine units being best for central stations of the fuel-burning-steam type, but in industrial plants there is more need to consider other units. Even where steam for process work and heat combined is less than 50 per cent of total required it may pay to consider a turbine-condensing set for the economical generation of current alone. Yet the majority need in this field calls for the utilization of the other prime-movers.

There is such a demand for steam for process work and heat in industries, which can be furnished by exhaust, that the demand for condensing units is small. Either it will pay to produce power with turbine-condensing units, or by using exhaust from the other types and by crediting this to the reciprocating unit the cost of power generation will be kept low.

With a careful study of present tendencies and possibilities and looking into the future for lower power costs and greater efficiencies, the situation with regard to prime-movers for the industrial plant may be summed up as follows:

The high-speed single valve engine will hold a place for itself for driving auxiliary equipment, and in multiple cylinder units as a stationary engine for industry, marine, and locomotive service, where simplicity and reliability are of prime importance.

The Corliss engine, where now installed in industry, may still find use, but will in the end give place to the poppet type of valve designed for work under extra high pressures and temperatures with a minimum of lubrication. Such engines should be multiple-cylinder, not alone for proper expansion ratio in volume, but for a mechanical design that will give a minimum first cost, floor space, and weight per unit of capacity.

The una-flow should find an increasing field in public buildings, hotels, and hospitals as well as in many industrial plants. It will survive as a single-cylinder engine for light and varying load conditions, working against a back pressure under 10 lb. gage, and limited to low- or medium-steam pressures, not over 125 lb. at the throttle.

The single-stage, small, and extravagant types of steam turbines for driving plant auxiliaries will give place to motor drive.

The field in which the high-pressure condensing steam turbine will hold its own has already been emphasized. New units, operating non-condensing, will have a field in industry, with keen competition from some of the reciprocating units. Properly designed units of the bleeder type will do the most in holding this field for the turbine.

The fact remains, that many agree that the reciprocating engine will have an increasing field in this competition with the bleeder turbine.

Water-Wheels and Internal-Combustion Engines

Waterpower development interests the central power plant promoter almost to the exclusion of the private plant owner. The cost is so great that although the cost of a hp. delivered to the switchboard *may* be less than for a fuel-burning, steam-electric plant, the chances are that it will not be much less. We must also consider the need of an auxiliary steam-electric plant in the northern climates and wherever low water at any time would interfere with full load conditions of the hydroelectric station.

Remembering that the total cost of installation of power plants including buildings, structures, and machinery, ranges from $100 to $180 per kw. for steam-electric, to an average of $450 per kw. for hydro-electric, one can see why the latter cannot do much better than the former in delivered hp. cost.

The use of the internal-combustion engine for auxiliary power in the central station and as the first source of power in industrial plants has grown by leaps and bounds within the last five years until Lucke estimates the present aggregate to equal 44,000,000 hp. in the United States alone. This is confined to small units, but owing to the adaptability and development of continuous, dependable operation of delivered hp. at low cost, the field of use is rapidly widening.

Oil for power is a by-product of the manufacture of gasoline, the supply of which is assured by the demand for 240,000,000 hp. in automobiles in the United States which will be curtailed only when the national supply dwindles. In the oil engine fuel substitutes, such as alcohol, can be used. The development of the oil engine into a continuous performing unit has caused it to take the lead in the internal-combustion field.

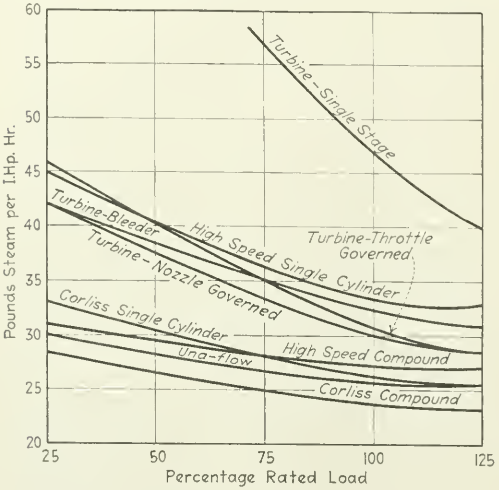

FIG. 1 COMPARATIVE STEAM RATES FOR NON-CONDENSING SERVICE

For these reasons the oil engine leads for industrial plant use, to the practical exclusion of the gas engine. With the exception of the small, general-purpose, farm type of engine, and semi-automatic lighting plants, the stationary gasoline engine has largely disappeared, being replaced by oil engines burning cheaper fuel.

The small gas engine once so largely used has suffered a decline, due mainly to the growth of electric distribution and electric-motor competition. The large gas engine of several thousand hp. per unit, developed to a high state of mechanical perfection in the double-acting tandem style, has not grown as was once expected.

In comparing the oil-electric plant equipment cost per kw., we find it closest to that of the steam-electric. The oil-electric prime-mover costs more per kw. than does the steam-electric unit, but as the latter must have a boiler and other auxiliaries, which the former does not, the comparison of complete equipments is nearly equal.

In most industries there is a demand for steam in manufacturing processes, heating, and drying that permits abstracting all or a greater part of the power required to operate the entire factory, so that the demand for condensing units should be small. The credit for use of exhaust steam in this way makes the generation of power cheaper, so that the central station cannot compete except in individual cases.

After a study of present tendencies and possibilities, and looking into the future for lower power costs and greater efficiencies, the situation with regard to prime-movers for the industrial plant may be summed up as follows:

The single-valve engine of the piston type will continue to survive for driving auxiliary equipment and as a multiple-expansion engine, where simplicity and reliability are of prime importance.

The Corliss type and other unbalanced four-valve engines will give way largely to the four-valve engine of the poppet type, designed for operation under extra high pressures and temperatures with minimum or no internal lubrication. Such engines should be compound- or multiple-expansion not only for higher mechanical and thermal efficiencies, but for better mechanical-engineering principles in engine design, higher piston speeds, reduced weights, lower first cost, and less floor space per unit of capacity.

The una-flow engine will continue to survive as a single-cylinder engine for light and varying load conditions working against low back pressure, but is limited to low or moderate initial steam pressures and temperatures.

The high-pressure-condensing steam turbine will find its greatest use in large units for central stations. Its use in the average industrial plant will give place to non-condensing or back-pressure units of economical design delivering steam for manufacturing purposes.

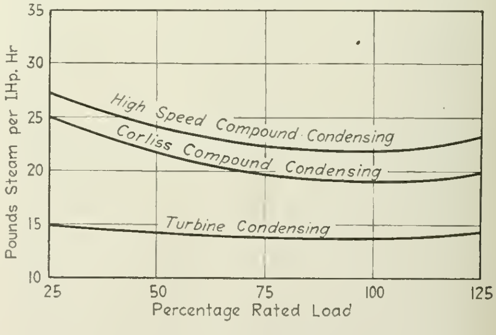

FIG. 2 COMPARATIVE STEAM RATES FOR CONDENSING SERVICE

The bleeder or extraction type steam turbine will have its field where the power demand is greater than the steam demand for process work, but this service calls for a high-class, efficient turbine carefully designed in accordance with the specific requirements of the plant.

The reciprocating steam engine will keep its place as a prime-mover in industry. In fact, at the present time, there are several factors pointing to a movement back to the engine for the average industrial plant.

The limitation of the hydroelectric prime-mover field has already been outlined in relation to the central-station development, and will apply to the industrial field only in isolated instances.

The internal-combustion oil engine is becoming more important every day as a prime-mover in the industrial field. The Diesel designers are tending toward solid-injection in place of vapor-air-ignition for the larger units to meet the competition of the successful small units of the non-Diesel-injection type. The latter are increasing in efficiency and reliability to the extent that they are a most important factor in industrial plant consideration. This is specially true at points isolated from coal and water centers.

Boiler-Rooms

As the boiler-room has become the most important factor in the cost of a commercial hp. in the steam-electric plants, the equipment there should be given much thought.

We have noted the phrase "fuel-burning-steam-electric" which means any fuel for use under the boilers, and that brings us to the respective merits of coal versus oil fuel. The price of coal has risen steadily as the years have passed, and never will be much less, although the quality is again improving. Still it is supreme as to the cost of a delivered steam hp. compared with oil fuel. The chances are that this comparison will always be so. All the reasons why, are too numerous for this discussion, but the facts have been revealed in many individual investigations by the author and seemingly verified by the oil companies themselves where we see them burning coal fuel in their own large power plants. Fifteen times during the last few years, the author has been called upon to investigate the question for as many different industrial concerns, and in spite of the hope that it was different, the resulting conclusions have been the same in each case. From this we can see that we must devote our attention to the best methods in the use of coal fuel.

Fire-Tube and Water-Tube Boilers

One point in reference to boiler design should be cleared up for the sake of definiteness, and that is in reference to the respective merits of fire-tube versus water-tube boilers. When boiler pressures are applied alike to each type and the service required is not over 125 per cent rating, either type is equally good in efficiency of fuel used. The fire-tube type embodies minimum floor space, larger water volume, and slower steaming qualities, while the water-tube type is given the opposite qualities, withal they both can be made to accomplish the same efficiency. As the pressures have gone higher with the demand for greater rating per tube area, the water-tube type is taking the lead in hp. installed.

As to boiler auxiliaries, the question of stokers seems to occur first in many cases. Small plants with one fireman cannot gain by the introduction of stokers, unless it is for greater boiler output regardless of the commercial cost of hp. produced. The greatest gain in economy by the use of stokers is from the labor item, and where this cannot be reduced, the upkeep costs of the stoker equipment are liable to exceed the gain in economy of fuel burned. The latter point can be covered by good firing aided by automatic draft and feed-water control.

Stokers are of the greatest service where labor-savings can be made, and, in the larger plants, for building up the output of a given boiler tube capacity. The latter point makes the stoker obligatory in large plants to increase the required grate area. Stokers require automatic feed of fuel, which in turn requires hoppers and overhead bunkers in most places. This collection of apparatus needs to be studied closely to find the line of demarkation where equipment first-cost and up-keep equals the expected savings.

Every boiler plant from the smallest up should have a feed-water heater sufficient to heat the boiler feed to the temperature called for by the pressure. Where over 50 per cent of the feed-water is raw, the closed-type heater is better suited to the needs. Economy lies in returning all the condensed steam possible to the boiler, and in this case, open heaters may better serve the purpose. It also is best to heat feed-water with exhaust steam from engines or pumps.

Draft and Feed-Water Regulation

Every boiler plant needs automatic regulation of the draft and feed-water control. This need not be a complicated, so-called "balanced draft" system, but can consist of damper and feed-water regulators attached to stack and feed-pump respectively. The stoker equipment may require a full-balanced draft system, but as with each step here outlined study the conditions of the special plant.

Economizers for feed-water heating, and air-heaters for pre-heating the air of combustion may not always be economical even if they do increase thermal efficiency. They add 10 or 15 per cent to the output of the boiler, but the gain may be counterbalanced by increased investment and operating costs.

The power item in most industries seldom reaches more than 5 per cent of the cost of the finished product, and in this fact may lie the reason that over 90 per cent of industrial plants operate their boiler-room with no real check other than the yearly costs of coal, wages, repairs, etc., and absolutely no record of steam hp. produced. The writer has been examining the operation of power plants for 30 years or more, and in most every instance has had first to establish performance records on which to base deductions as to the capacity of the plant, power factor, costs of boiler hp. produced, and all the various items that enter into a consideration of what is best in an individual case. This experience has been in the eastern section of the country, but my fellow engineers in all the other sections report the same conditions irrespective of locality. Not even instruments to get the basic figures of steam produced and the amount of coal used are installed as part of the equipment in many plants.

Every boiler-room should be equipped with coal scales or other accurate coal-weighing devices and a recording water meter of some approved and reliable type. Although it would be ideal to have these instruments arranged to record coal and water for each boiler separately, this, perhaps, is an unnecessary refinement. if each unit has some indicator to show relative quantities. Recording-steam-flow meters will provide sufficiently accurate records for apportioning the total water. If underfeed stokers are used, a stroke counter on the crank-shaft will answer for the coal. Then the total weight of the water can be charged to the individual boilers in proportion to their steam output, and the total weight of coal can be distributed according to the stroke count. For other types of stokers there are available various coal meters instead of stroke counters.

In a boiler-room without stokers, some system of coal weighing can be installed even if it be so simple as a platform scale on which to wheel each barrow load of coal as it passes to the firing floor. There is not room here to elaborate on the various weighing combinations or devices but the insistence is that no boiler-room should be without one. The same insistence applies to the use of some form of feed-water measurement, of which there are now many devices available. These two types of equipment are absolutely essential in all boiler-rooms and when possible should be augmented by a recording feed-water temperature gage, draft temperature, and draft pressure gages. With stokers should go a more complete equipment of draft gages for wind box or under the fire, over fire, back connection, and base of stack. Fire-room instruments should be augmented with a recorder in the engine-room such as a recording kw. meter or other device necessary to show the load demand on the boiler-room. Recording steam gages on boiler and engine-room lines are requisite.

Boiler-room instruments such as suggested here, will lead to the analysis of each shipment of coal received. and this can be taken care of by the factory chemist or the engineer in charge if he is furnished with a bomb calorimeter. Thus can the quality of fuel be checked up, the quantity used be shown as consistent or not with the quantity of steam produced, and unit costs worked up for comparison. Every boiler-room should be considered a separate department for the manufacture of steam, and its production accounted for with the same detail as is used in the other departments. Why not?

Electrical Equipment

The general rule applies that alternating current equipment is the cheapest to purchase and operate, although there are many special places where direct current may be obligatory. Even then, it may be best to generate alternating current and convert to direct. Alternating current calls for high primary voltages which must be stepped down for commercial use, but it spells "less copper" and, therefore, less first cost.

Switchboard and transformer equipment for high tension service requires oil-operated, automatic overload switches, as well as oil-operated throw switches. Bus-bars should be given ample room from board instruments as well as adjacent walls. Fire risks require the switchboard room to be isolated from the machine-room. In fact, the electrical equipment must be well thought out to cover all the points of economy, and safety of operators and property.

No equipment in the power plant is more susceptible to loss by overload than electrical equipment, and so should be designed amply large in every detail.

General Conclusions

At the present time all classes of prime-movers discussed with whatever auxiliaries each requires for commercial hp. production are near even in production cost. Some are better than others under special conditions, but if each installation were exactly fitted to the total requirements of the individual plants, the power production costs would be found on an almost flat curve.

Present rates may be reduced somewhat, but the greatest benefit lies in checking the tendency to rise, and the preservation of a normal rate for some time to come. The question will arise in the mind of the reader as to whether he should purchase power of the central station or generate in his own plant, and if the latter, what class of prime-mover will he use? Dividing the industries into three classes we answer the question as follows:

1. Industries using power, with steam only required for heat, will purchase power from the central station and generate steam only for heat. In isolated sections, the industry may find their own plant of oil-electric prime-movers the best solution.
2. Industrial plants requiring power, and steam for process and heat, in general will generate their own power by steam-electric prime-movers, or, in isolated sections, by means of oil-electric prime-movers.
3. Plants whose processes give a large amount of by-product or waste available as a fuel, should generate their own power as the basic cost of it is in fuel.

In other words this whole discussion discloses the fact that the central stations and private-owned plants each have an open field, with all classes of prime-movers finding a field of service, because rates are now so near equal.

If the purchase of power from the central station looks inviting to the private plant owner, he should have a competent engineer to go over load conditions that are to be met in order that the most advantageous rates obtainable will be supplied. Where a private plant for all needs seems best, the engineer should first study conditions. By "engineer" is meant one in the regular employ of the company or an outside consultant, but always one who is not a sales engineer for any engineering device.

Low-Cost Handling of Coal and Ashes

A System Suited to Industrial Power Plants

By FRITZ SCHULTZ

Chief Engineer, George Ehret Brewery

IN a manufacturing plant which generates its own power it is very important to save money wherever possible. For this reason, it is practically always economical to handle coal and ashes by mechanical means. The cost of labor and attendance is one of the big factors in the expense of running a power plant and as conveying equipment eliminates a large portion of the labor in a power house, it almost always pays to install it.

The coal-handling equipment in our plant has a capacity of 46 tons per hr. It has taken care of as high as 20,000 tons annually. The coal is delivered along the waterfront by barge, a distance of about a quarter of a mile from our plant. We engage a hauling company to transport it from the barge to our power house. The capacity of the trucks handling coal is five tons.

Before the installation of coal-handling equipment, as it now exists, was made, the trucks used to drive in one of the buildings and dump the coal into the hopper of a skip hoist which elevated it to the bunkers. Beside being somewhat of a nuisance this procedure was more expensive, as it involved operating the trucks in narrow quarters and slowed up the process of unloading. Hence, some time ago the installation was altered and a bucket-conveyor system was substituted for the skip hoist.

Index Number
658.281:662.65 Mechanical
handling of coal

Trucks now back up to the curb in front of the plant and dump the coal into a large hopper installed in the sidewalk. It falls down a distance of 5 or 6 ft. into a revolving filler or feeder, Fig. 1. This filler consists of a circular drum to which are fastened gates or shutters to regulate the flow of coal. These gates can be moved in or out until the desired width of opening is secured for the correct rate of coal discharge, and then are clamped into place. Whenever soft coal is handled, the openings left by the gates are larger than those for hard coal, because of the difference in rate of flow. The filler is supplied with coal from the side by means of a chute leading from the outside of the building.

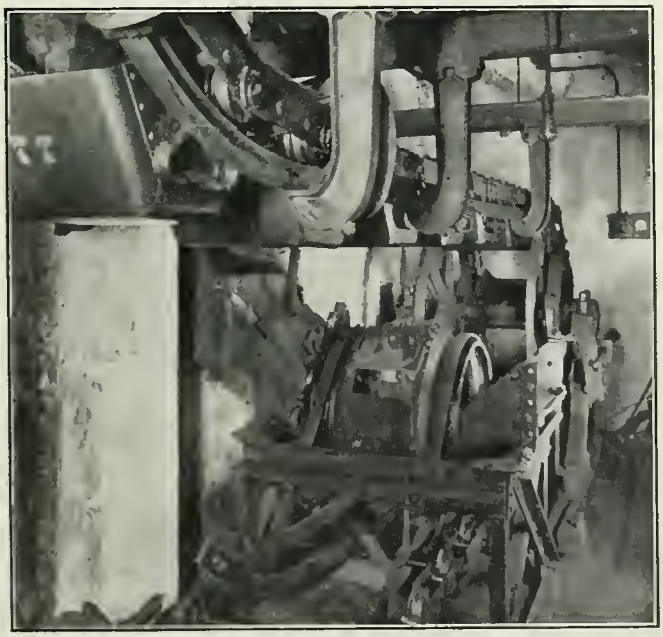
FIG. 1 REVOLVING FILLER FOR BUCKETS

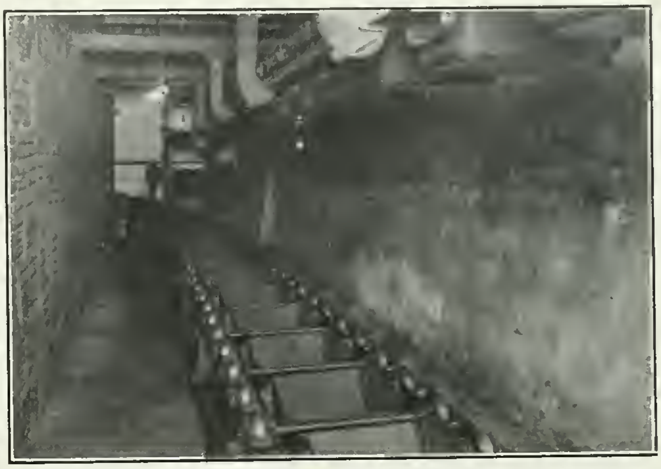
FIG. 2 BUCKET CONVEYOR LEADING TO ELEVATOR

The filler discharges coal into the buckets, as it revolves in synchronism with them, and regulates the flow, as outlined above, so that each bucket will carry a maximum load, about 80 to 99 lb., but will not spill its contents. There are 142 buckets in the system and they make a complete circuit once every 8 min. Buckets are filled on the lower line of the conveyor and then pass around the drum to the upper level. They then travel back a distance of approximately 90 ft., as shown in Fig. 2, where the conveyor system turns through a guide and becomes a bucket elevator, Fig. 3. The lift of this elevator is about 55 ft. After passing around the second drum, the buckets travel horizontally again for a distance of about 25 ft. where they pass over a third drum and start on their return course.

Just after making this last change in direction, the buckets pass over a tripper which turns them upside down and discharges their contents into a large hopper. The empty buckets, after passing over another drum, are carried down the elevator shaft again in a line parallel to the up-coming buckets, travel over a drum at the foot of the elevator shaft and back along the lower level to the filling point. This belt-conveyor system, including the elevator section, is operated by a 15 hp. motor through belting and gearing. When started, 7½ hp. is sufficient to keep it running. The actual drive is by means of a pawl arrangement which engages with the bucket chain. This mechanism is shown in Fig. 4.

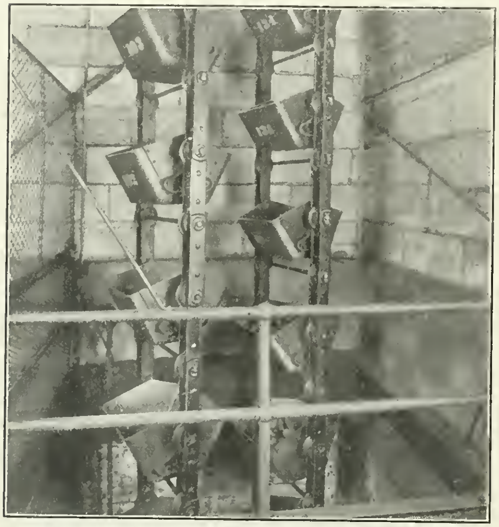

FIG. 3 ELEVATING SECTION OF BUCKET CONVEYOR

Flexibility of Bucket Chains

The special element of flexibility which characterizes the type of chain employed, enabled us to locate the conveyor in a place which was out of the way and at the same time was convenient. We were able to turn the line of motion at an angle of 30 deg. by putting a gradual twist in the chain in both the up and down lines of the elevator. That is, when the up-going line of buckets reaches the top of the shaft they are carried horizontally in a direction at an angle of 30 deg. with their original horizontal course. Likewise, in descending the shaft, a twist is put in the chain which enables the buckets to be carried back through the lower passageway in a line which is almost but not quite parallel with the line of full buckets proceeding back to the elevator shaft. This layout is shown diagrammatically in Fig. 5.

Up to this point very little labor and attendance has been involved in running the installation. The truckmen do their own work outside of the building, including cleaning up any spillage after each truck is empty. An occasional inspection of the feed mechanism and a little cleaning up occasionally, where a rush of coal has discharged a shovelful or two of the fuel on the floor alongside of the feeder, is all that is required except a little watching of the motor and drive at infrequent intervals merely to see if everything is running all right. All of this is done by the regular plant operators, no special helpers being necessary.

At the point where the coal is discharged into the hopper at the top of the building a man is kept in constant attendance when any coal is being delivered. His function is to weigh the coal and to operate the car which discharges it into the storage bunkers. This car, Fig. 6, has a capacity of 1 ton, while the capacity of the hopper itself is about four carloads. In the course of a day's operation, this reserve capacity is quite sufficient to take care of any piling up of coal if truck loads are delivered at a rate faster than the weighman can handle them upstairs.

Weighing and Distributing Coal

The hopper is provided with a discharge gate. With the delivery car located beneath the hopper, the man pulls a lever and allows the car to be filled with coal. He then shuts this lever off, turns around, balances the scale, on which the car rests, and records the weight by inserting a card in a register on the scale, which punches the net weight automatically. These cards are collected and sent to the office twice a day. After this is done he gives the car a shove to push it out on an incline track, Fig. 7. It travels down this track at an accelerated speed toward a bumper. This bumper can be moved back or forth so that the car will hit it and discharge over any desired section of the storage bins, according to the needs for fuel.

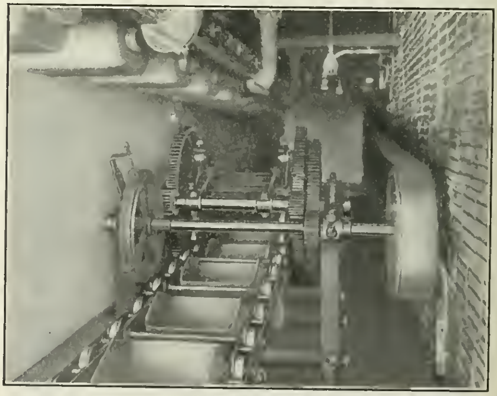

FIG. 4 DRIVE MECHANISM FOR CONVEYOR

When it reaches a point near the end of its travel the car picks up a counterweight by means of a cable running over a sheave. The momentum of the car is sufficient to pull this cable and raise the counterweight to the required height. The pull on this cable also decelerates the car so that it hits the bumper at a much reduced speed. On the bumper are located stops

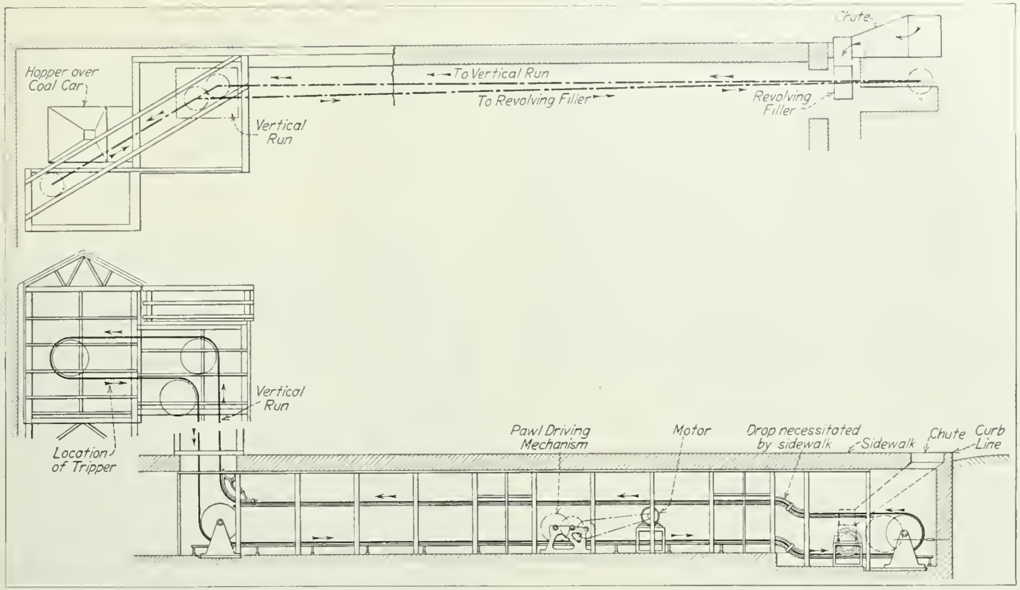

FIG. 5 DIAGRAMMATIC LAYOUT OF CONVEYOR SYSTEM FROM FILLER TO DISCHARGE HOPPER

which trip the side dump gates on the car. These gates are hinged at the top and open at the bottom, and the bottom of the car is inclined in both directions to facilitate the discharge of coal.

As the coal falls out the weight of the car is, of course, decreased, this decrease being sufficiently great to allow the counterweight to overbalance the weight of the empty car. The downward pull of the counterweight starts the car on its return journey and gives it a speed sufficient to carry it to the top of the incline. This speed, of course, is lower when the car travels to a near point in the bunkers than when it goes to the far end. The length of the incline is about 125 ft. and it runs the entire length of the coal bunkers.

The capacity of the storage bins is 1500 tons. This capacity is necessary because of the fact that enough reserve supply must be on hand to take care of any failure of barges of coal to arrive on schedule time.

Ashes are removed from the ash pits at the front of the boilers and are handled by wheelbarrow. At the end of the boiler-room and facing the boilers is a large receiving hopper. This hopper feeds into a skip hoist which is about 55 ft. high. Ashes are dumped into the hopper and elevated to a storage bin at the top of the building. From this point they are discharged through control gates into trucks. All of the ashes from our plant are removed without cost to us by contractors who use them in making concrete for building floors, sidewalks, etc.

The action of the hoist is largely automatic. By throwing in the switch and then pulling the lift cable the hoist motor is started, winding up the skip cable on the drum and lifting the hoist to its discharge point, Fig. 8. The hoist is accelerated on its upward travel and then decelerated at a rate sufficient to slow it down without jarring, but to leave it enough momentum to reach the top and dump. The driving mechanism is then reversed by pulling down on the control cable, the mechanism automatically accelerating and decelerating the bucket on its downward journey. At the end of each trip the hoist automatically stops and the lift cable must be operated again to start in on another cycle. The handling of ashes is taken care of by the boiler-room firemen without any additional assistance, and the work is done between the periods when the boilers must be fired and the fires cleaned. The motor drive is located in an adjacent room.

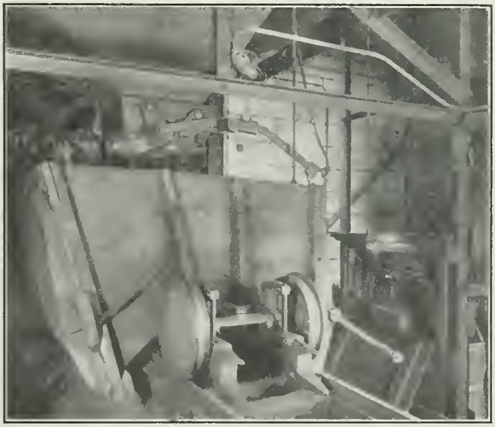

FIG. 6 CAR FOR CARRYING COAL TO BUNKERS

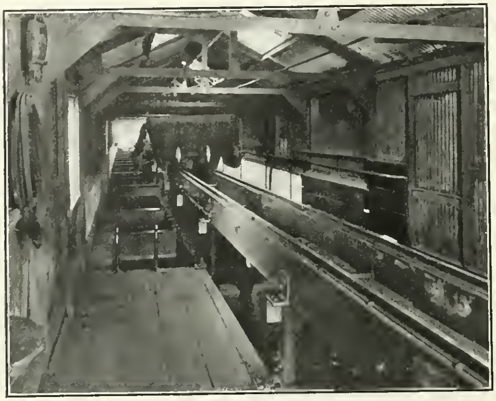

FIG. 7 INCLINE RAILWAY OVER COAL BUNKERS

The entire apparatus has been working satisfactorily ever since its installation and has well repaid its cost. The ash hoist was put in during 1908 and the present coal-handling equipment in 1914. As we have not used hand labor for handling our coal for many years back, no comparisons are on record of the cost of this method relative to the present conveyor system. The approximate cost of handling coal from the delivery truck to the boilers is 9 cents per ton, including maintenance and repair charges. The handling of ashes we figure at 2½ cents per ton, including maintenance costs, and repairs to the steel hopper and ash bunkers.

Each Thursday men go over the entire installation to inspect it and repair any damaged or worn parts. This keeps it in first-class shape.

The cost of maintenance and repairs on our coal- and ash-handling equipment has been insignificant. During the past 10 years the total expense for this purpose has been but $4000, limited largely to bucket rods, portions of chain, and rusted out parts of hoppers and bins. The entire installation was built and set up by the C. W. Hunt Company, and has never at any time broken down nor failed to perform its full service.

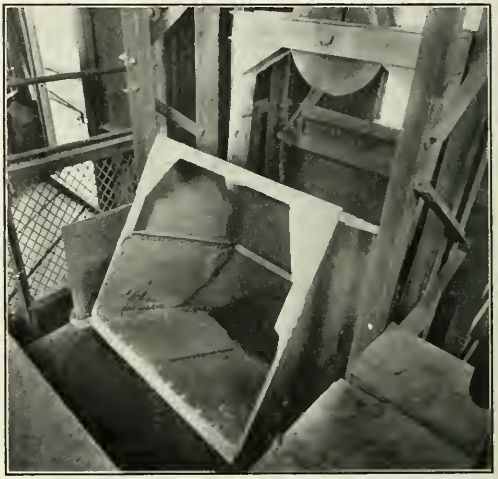

FIG. 8 SKIP HOIST FOR ASHES JUST AFTER DISCHARGING

Keeping Power Plant Instruments Accurate

Index Number
621.3175 Electric meters

MEASUREMENT of performance is a standard requirement in every well-run manufacturing plant. Consistent progress can be made only where such measurements are regularly taken.

But the measuring instruments themselves must be inspected and tested frequently to make sure that their readings check with some standard. It is useless to buy good instruments if nothing is done to keep them in repair.

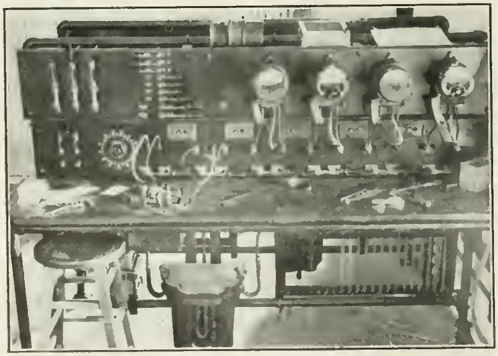

FIG. 1 TESTING BENCH FOR ELECTRIC METERS

In the power plant, especially, it is necessary to be certain that all indicating and recording devices give correct readings. State laws compel careful inspection of steam gages, water columns, etc. The very running of the plant, also, depends directly on many such appliances. The rest are often neglected.

Public utility companies and municipalities which run their own power plants and sell service, keep their instruments, particularly customers' meters, in condition to read and record accurately. Testing departments are engaged constantly in this work. Fig. 1 shows the kind of testing bench used for electric meters by the City of Los Angeles. As the volume of work is great, these benches are fitted up for the mounting of 5 meters at a time, thereby saving considerable time.

The industrial power plant will not need such elaborate equipment. But regular inspection, testing, and repair of instruments must be done to make sure that the power house is run efficiently. Money spent in maintenance is amply repaid by resultant savings.

Savings Produced by Power Equipment

Experience Data from Typical Industrial Plants

By GEORGE E. HAGEMANN

Associate Editor, MANAGEMENT AND ADMINISTRATION

POWER is usually but a small fraction of operating expenses in manufacturing plants. However, many instances are on record of worth-while savings that have been brought about by the installation of suitable equipment, including auxiliary apparatus and power plant instruments. This article gives data on a few examples of such savings.

The Penn American Refining Company has installed in its Plant No. 1 at Rouseville, two 300-kw. noncondensing turbo-alternator units made by the Kerr Turbine Company. These turbines operate under 150 lb. steam pressure, 100 deg. fahr. superheat, and exhaust into stills at 25 lb. gage pressure. This installation has replaced the former practice of purchasing power and of supplying live steam to the stills through reducing valves. As a result a clear saving of \$3000 is made each month (\$36,000 per yr.) by the company. This practice of utilizing exhaust steam at considerable back pressure on turbine and engine units has proved to be a very economical procedure in industrial plants requiring steam under some pressure for manufacturing processes.

The Robert Gair Company, in their Montville plant, experienced a great deal of trouble due to heavy foaming in the boilers. This was caused by the large amount of organic matter suspended in the feed water. The foam frequently went through the superheater and even into the engines. About 100,000 lb. of water were evaporated per hour and a slug of foam was carried over almost every 15 to 30 min., often eliminating the superheat and always reducing the speed of the engines.

Beside causing a slowing up of the plant machinery and consequently a loss in production, the trouble involved a very heavy maintenance expense on the engines. The slugs removed all the oil from the engine cylinders, necessitating constant changing of packing rings and frequent re-boring. Engines which should run 5 years without overhauling had to be gone over every 6 months. In addition, traps and valves along the steam line clogged up every one to two weeks and required constant cleaning.

Installation of Tracy steam purifiers has cut out at least 95 per cent of this trouble. Superheat is now constant, cleaning of traps and steam lines has been almost eliminated, and engine repairs have been cut to a minimum. Table 1 shows details of the savings.[1]

Index Number
658.16 Power apparatus

At the plant of the White Eagle Oil and Refining Company \$20,695 has been saved each year through the use of a Graver hot process softener for treating the feed water. The hardness of the water has been reduced from between 15 and 18 grains to 1½ grains per gal., and scale has been practically eliminated from the boilers. Steam is used for agitating the oil in the topping stills, for heating and for running pumps. It is generated at 95 lb. pressure by ten 150-hp. tubular boilers, and two 350-hp. water-tube boilers.

Boiler feed water is run first to a condenser where it cools the cooling water for the stills. This raises its temperature and also precipitates some of the sediment, which is taken out in two settling tanks, used alternately. From this point the water goes to the open heater of the Graver installation, is raised to 212 deg. fahr., and treated with chemicals proportioned according to the rate of flow. Solids are removed in a precipitation tank and the water is then filtered. The filter is washed out 3 times a day and every 3 months is cleaned thoroughly. It is most important for this plant to avoid foaming or priming in the boilers because the steam used in the still for agitating must be dry and of high temperature. Without feed-water treatment, slugs of cold water would be carried over into the stills causing the oil to pop. If this action occurs violently oil will be scattered over a wide area and cause a disastrous fire.

TABLE 1. TRACY STEAM PURIFIERS

Robert Gair Co.

OPERATING COST	
Depreciation—\$750 ÷ 15 yr. of life	\$50.00
Average interest[1] at 6 per cent $= \frac{16}{15} \times \frac{\$750 \times 0.06}{2}$	24.00
Maintenance, repairs, cleaning, etc.	15.00
Total cost per year—1 purifier	\$89.00
Cost per day—\$89 ÷ 280 days	0.32
SAVINGS EFFECTED	
Extraordinary repairs eliminated	\$600.00
Saving due to higher average superheat and more even and efficient operation of engines—35,000 tons × 0.02 × \$6.25	4,375.00
Total gross saving, per year—4 boilers	\$4,975.00
Deduct operating cost of purifiers—4 × \$89	356.00
Total net saving per year—4 boilers	\$4,619.00

This saving pays for the Tracy purifiers in less than 8 months.

[1] Allowing for interest earned by depreciation reserve.

The fire-tube boilers are shut down but 2½ days every 2 months for cleaning, and at this time only

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[1] Reports on steam purifiers, water softeners, feed-water regulators, CO_2 recorders, soot cleaners, Republic steam flow meters, oil purifiers, and furnace lining compiled by and furnished through the courtesy of The A. C. Nielsen Co.

TABLE 2. GRAVER WATER SOFTENER, 9000-GAL. CAPACITY
White Eagle Oil & Refining Co.

COST OF OPERATION	
Depreciation—$7,000 ÷ 15 yr	$466.66
Average interest[1] at 6 per cent = $\frac{16}{15} \times \frac{\$7,000 \times 0.06}{2}$	224.00
Repairs	150.00
Maintenance, washing and cleaning—946 hr. at $0.50	473.00
Power for pumping and agitating 8,760 kw. hr. at $0.03	262.80
Soda ash—105 lb. per day × 365 days × $0.03	1,149.75
Lime—300 lb. per day × 365 days × $0.02	2,190.00
Total cost of operation per year	$4,916.21
Cost of operation per 24-hr. day	13.47
SAVINGS EFFECTED BY GRAVER HOT PROCESS WATER SOFTENER OVER COLD PROCESS	
Cost of cleaning boilers when using cold treatment—15,768 hr. at $0.50 = $7,884	
Cost of cleaning boilers when using Graver hot process—6,660 hr. at $0.50 = 3,330	
Saving in cost of cleaning boilers	$4,554.00
Saving in fuel through better heat transmission—15,573 bbl. at $1	15,573.00
Saving in fuel to heat boiler after cleaning—568 bbl. at $1	568.00
Saving per year due to using Graver hot process system	$20,695.00
Net annual return on the investment	296 per cent

[1] Allowing for interest earned by depreciation reserve.

about a bushel of sediment is found in the mud drum. The water-tube boilers are inspected for a period of 2 days every 3 weeks. With raw water, fire-tube boilers would be out of service for cleaning 4 days each month and water-tube boilers 3 days every 2 weeks.

Other savings result from better heat transfer, reduced maintenance charges, saving of investment in additional boilers, and economies of hot treatment over cold treatment of hard water. The demonstrated savings are listed in Table 2.

Regulation of feed water is an important element of boiler operation, especially where waste heat is utilized to generate steam. One of the large by-products companies operates 9 such boilers and also 4 others which burn coke breeze. The 9 U. G. I. boilers are rated at 200 hp. while the 4 Stirling boilers which burn the coke are of 700 hp. each.

The waste-heat boilers burn the gases discharged as waste from water-gas generators. They operate under a burning period of 2½ min. and then a 2-min. period during which the gases are shut off. Without a good system of regulation the water level in the boilers would vary an exceptionally large amount. Previous to making the installation of feed-water regulators this variation in level was at least 20 in. When the load came on, the boilers see-sawed back and forth. Since the regulators have been in use the average variation of the water level has been but 9 in. One man now attends to the regulation of water level whereas 2 were formerly required.

The 4 Stirling boilers are fired by chain grate stokers, and, as firing is not attended by a large variation in fuel supply, the water level is more easily maintained. Due to the improvements brought about by the feed-water regulators, the efficiency of the boilers has been increased. As no actual test has been run, however, the amount of this increase is not definitely known. Table 3 gives the calculations of economies produced by the installation.

It is practically impossible to operate a power plant economically without a means of checking up on the CO_2 content of the flue gas. The Sun Oil Company is saving $38,178 a year on its fuel bill by the use of Republic CO_2 recorders to make sure that the most value is got out of the fuel burned.

This company operates 7 oil-burning Heine boilers, each of which is equipped with one of these CO_2 recorders, and also with a Republic flow meter. Five of the boilers are rated at 500 hp. and 2 at 250 hp. They are under load 24 hours a day, the day load being about 180 per cent of rating and the night load about 120 per cent of rating. Steam is used for manufacturing purposes as well as for the generation of power.

Previous to installing the Republic recorders the CO_2 content of the flue gases was tested only once a day with an Orsat hand set, obviously a very unsatisisfactory and unreliable index of actual average operating conditions. The recorders, of course, give the CO_2 content for the entire cycle of each day. The average CO_2 in the flue gas was formerly 8 per cent, but through the use of the recorders it has been increased to 12 per cent. In Table 4 the detail calculations of savings are shown.

TABLE 3. COPES FEED-WATER REGULATORS
A Large By-Product Company

OPERATING COST OF 13	
Depreciation—$3,250 ÷ 20 yr (cost + installation)	$ 162.50
Average interest[1] at 6 per cent = $\frac{21}{20} \times \frac{\$3,250 \times 0.06}{2}$	102.38
Repairs and maintenance, including oiling, inspection, and cleaning	65.00
Cost per year	$ 329.88
Cost per regulator per year—$329.88 ÷ 13	25.40
SAVING EFFECTED	
Saving in labor—1 man per 8-hr. shift—$6 × 3 × 365 days	$6,570.00
Cost of operating 13 Copes feed-water regulators	329.88
Net saving per year	$6,240.12
Net annual return on the investment	192 per cent

[1] Allowing for interest earned by depreciation reserve.

If most of the available heat is to be usefully applied in a boiler, soot must be kept off of the surfaces through which this heat is transferred. The Miller Rubber Company has successfully employed Vulcan soot cleaners for this purpose, effecting a saving of $7020 in fuel per year.

In 1920 the company installed 5 new 650-hp. Stirling boilers, equipping each with 6 Vulcan soot cleaner elements. About 70 per cent of the steam is used for process work in the factory, and the remainder for pumps and other power purposes. Before the new boilers were installed the available steam was inadequate for production purposes. Now, however, 3 boilers will carry the full load of the plant, operated at from 100 to 120 per cent of rating for 24 hours per day, 6 days per week. On Sunday one or two boilers are able to carry the load.

The soot cleaners are operated 4 times in the 24 hours: at 6 A. M., 12 noon, 7 P. M., and 1 A. M. The time required is about 5 minutes per boiler. During the operation flue gas temperature drops from about 625 deg. fahr. down to 550 deg. or less Then it

TABLE 4. REPUBLIC CO_2 RECORDERS

Sun Oil Co.

Cost of Operation—1 Recorder	
Depreciation—$287 ÷ 15 yr.	$19.13
Average interest[1] at 6 per cent $= \frac{16}{15} \times \frac{\$287 \times 0.06}{2}$	9.18
Maintenance and repairs, labor and materials	20.00
Total cost of operation, per year	$48.31
Cost per day—$48.31 ÷ 315 days	0.15
Savings Effected by 7 Recorders	
Per cent CO_2 obtained with recorders—average	12 per cent
Per cent CO_2 obtained without recorders (approximately)	8 per cent
Per cent saving in fuel	8.5 per cent
Fuel burned in 24 hr. by one 500-hp. boiler	7,200 gal.
Saving in fuel with recorders—7200 × 8.5 per cent	612 gal.
Saving per day, average—612 gal. × $0.033	$20.20
Saving per year per 500-hp. boiler—$20.20 × 315	6,363.00
Saving per year with all 7 recorders on five 500-hp. and two 250-hp. boilers, average	38,178.00

This saving pays for the entire cost of the recorders in less than 2 weeks' full operation.

[1] Allowing for interest earned by depreciation reserve.

gradually increases up to 625 again. The average is between 575 and 600 deg.

Hand lances for direct steam-blowing were unsatisfactory because of the cold air which got into the boilers during the progress of this work. Such cleaning could be done only on Sunday. During the week, enough soot accumulated on the heating surfaces to keep the flue gas temperature as high as 700 deg. The savings which have been brought about by the use of the Vulcan cleaners are shown in Table 5.

Steam Flow Meters

In a well-run power plant steam flow meters are considered fully as essential to efficient boiler operation as watt-meters are to a satisfactory generator operation. In the plant of the Sloss-Sheffield Steel and Iron Company, at Birmingham, Republic steam flow meters are utilized for each of the eight 600 hp. Stirling boilers. Four of these boilers burn by-product gas, two have stokers and burn coke breeze, and two are equipped for gas, coal, powdered coke breeze, or powdered coal. Boilers are run at 150 per cent of rating, which is the point of maximum efficiency.

The integrating meters are read at 6 A. M. every day, and the 24-hr. efficiency of each boiler is calculated. Firemen by the aid of steam flow meters keep the boilers up to the most economical load balance. As soon as any boiler drops below 100 per cent of its rating it is cut out. Average efficiency, using the meters, is about 75 per cent. Without meters it was approximately 65 per cent.

TABLE 5. VULCAN SOOT CLEANERS

The Miller Rubber Co.

Cost of Operation	
Depreciation—$2,800 ÷ 7 yr.	$400.00
Average interest[1] at 6 per cent $= \frac{8}{7} \times \frac{\$2,800 \times 0.06}{2}$	96.00
Repairs and maintenance	40.00
Labor—¼ hr. at $0.77½ × 4 blows × 365 days	282.88
Steam—not figured—no more steam used than with hand lance	
Total cost of operation per year	$818.88
Cost per day—$818.88 ÷ 365	2.24
Saving Effected	
Yearly saving in fuel—36 tons × 52 wk. × $3.75 per ton	$7,020.00
Cost of operating soot blowers	818.88
Net annual saving by Vulcan soot cleaners	$6,201.12

[1] Allowing for interest earned by depreciation reserve.

The daily saving of coal due to the use of the steam flow meters is 4 tons per boiler. As 7 boilers are in operation at a time, the net annual saving is in excess of $22,400, an annual return of over 700 per cent on the $3200 invested in the meters. In addition, excess overloading of boilers beyond 300 per cent of rating is prevented, effecting an appreciable saving in boiler repairs which would have to be made if such overloads were carried for more than very short periods.

Steam flow meters have also been very useful in the distributing lines. In this plant four of them are used on turbo-generators, two on auxiliary drives in the power plant, two on other auxiliary drives, one on a vacuum pump, and one on exhauster gas engines. These meters show water rates of the machines and also warn when re-blading of turbines is necessary. In the case of the exhauster gas engines, the meters detect faulty valves and other sources of inefficiency. As a result a great saving in steam has been brought about. Calculations showing the savings accomplished in the plant by the use of the flow meters are given in Table 6.

TABLE 6. REPUBLIC STEAM FLOW METERS

Sloss-Sheffield Steel & Iron Co.

Annual Operating Cost of 8 Republic Steam Flow Meters	
Depreciation—$3,200 ÷ 10 yr. of life	$320.00
Average interest[1] at 6 per cent $= \frac{11}{10} \times \frac{\$3,200 \times 0.06}{2}$	105.60
Repairs, inspection, and checking	100.00
Charts	29.20
Power—3,504 kw. hr. at $0.0025	8.76
Total cost per year—8 meters	$563.56
Cost per meter per year—$563.56 ÷ 8	70.45
Cost per meter per day—$70.45 ÷ 365	0.19
Savings Effected by 8 Republic Steam Flow Meters	
Approximate average boiler efficiency, using flow meters	75 per cent
Approximate average boiler efficiency, without flow meters	65 per cent
Increase in efficiency due to flow meters	10 per cent
Saving in fuel (reduced to coal basis)—28 tons per day × 365 days = 10,220 tons at $2.25	$22,995.00
Operating cost of meters	563.56
Net annual saving	$22,431.44
Net annual return on the investment	701 per cent

[1] Allowing for interest earned by depreciation reserve.

Boiler-Room Meters

Bailey boiler meters to record steam flow, air flow for combustion, and flue gas temperature, are used at the Aberfoyle Manufacturing Company. This company operates five boilers, four of 500 hp. and one of 300 hp. Before the meters were installed a shortage of power seemed to exist and an additional boiler installation was contemplated. After the meters were put in operation, however, it was evident that the power house could carry heavier loads on two of the 500-hp. boilers and the one 300-hp. boiler. Peak loads are now easily handled with the three 500-hp. boilers.

TABLE 7. No. 300 DE LAVAL OIL PURIFIER

A Large Pipe Line Company

COST OF OPERATION		
Depreciation—$950 ÷ 20 yr. of life		$47.50
Average interest[1] at 6 per cent $= \frac{21}{20} \times \frac{\$950 \times 0.06}{2}$		299.25
Maintenance and repairs		15.00
Labor (cleaning)—$0 50 per day × 365 days		182.50
Kerosene for heater—$0.15 per day × 365 days		54.75
Power—2190 kw. hr. at $0.01 per kw. hr.		21.90
Total annual operating cost		$620.90
Cost per day—$620.90 ÷ 365 days		1.70
Cost per gallon oil purified—$1.70 ÷ 84 gal		0 0202
SAVINGS EFFECTED BY OIL PURIFIERS AT 9 MAIN LINE AND 2 GATHERING STATIONS		
Time required for taking up bearings:		
Before De Laval system was installed		
921 man-hours per month at $0.60 per hour × 12 months		$6,631.20
Under present conditions		
¼ of above—$6,631.20 ÷ 4		1,657.80
Saving in time for taking up bearings per year		$4,973 40
Replacement of burned-out bearings		
Saving in labor and material:		
$360 per month × 7 large stations × 12 months	$30,240	
$100 per month × 4 smaller stations × 12 months	4,800	
Annual saving bearing replacement, 11 stations		35,040.00
Total saving per year due to oil-purifying system		$40,013.40

[1] Allowing for interest earned by depreciation reserve.

Following the installation of the flow meters all departments using steam increased their production. In some cases this increase amounted to 40 per cent. Despite this fact, however, the company was able to reduce expenses chargeable to the boiler-room by $1500 a month, a clear saving of $18,000 per year.

Oil Purifiers

Diesel engines require an abundance of lubricating oil for successful operation. This oil picks up a great deal of dirt in the course of its circulation, and the dirt must be removed before the oil can be used again. For this purpose one of the large pipe-line companies has installed De Laval oil purifiers at each of its 9 main-line pumping stations and in two of the smaller stations. The company operates 13 Diesel engines on pumps and one engine on auxiliaries at its main-line stations. The engines are De La Vergne, Snow, and McIntosh and Seymour, of 300, 150, 80, and 40 hp.

Each engine has an oil tank holding one barrel of oil, which flows by gravity through all the bearings of the machine and thence to a tank below the engine. From this point it is forced by air to another tank over the De Laval purifier. Through this it runs twice, is tested for viscosity, and then is forced by air into the engine feed tank again. Two barrels of lubricating oil per day run through the purifier, the oil being heated to 110 deg. fahr. by a 3-burner kerosene heater.

The De Laval purifier removes water, metallic particles, and the larger particles of carbon from the oil. The bowl of the separator is cleaned once or twice per day.

Many advantages have resulted from the use of these purifiers. Formerly reclaimers were employed, but they were difficult to operate and did not give good results. While it used to be necessary to take up main bearings and crank pin bearings about once a month, now they are taken up only once in four months. During the course of one year bearing efficiency was 91 per cent as compared with 15 per cent under previous methods; that is, in 100 of the daily reports which are kept of bearings, only 9 now contain records of trouble, whereas previously 85 of these daily reports out of 100 recorded difficulties with bearings. The improvement is due to the De Laval purifiers.

Under previous operating conditions bearing maintenance took 921 man-hours per month for the 9 main line and 2 gathering stations. It is only about one-quarter of that now. This saving in time is worth $4973 per year, while the reduction in number of burned-out bearings saves $35,040 annually, as shown in Table 7.

The maintenance of fire-box linings must be carefully watched if boilers are to be operated efficiently. The Sun Oil Company have been using Thermolith to repair linings in their five 500-hp. Heine boilers, with economies as shown in Table 8.

These boilers operate under severe conditions. They are under continuous load, day and night, at 140 to 180 per cent of rating. Four are usually on the line, the fifth being used as a standby to assist in meeting the peak load. As all of the power plant equipment of this company is of a high class, maintenance is given special attention in order to realize the biggest return on power investment.

TABLE 8. THERMOLITH FIRE-BOX LINING

Sun Oil Co.

SAVINGS EFFECTED BY USING THERMOLITH FOR RELINING BOILER FIRE-BOXES		
Cost of relining one boiler with fire-clay:		
Fire-brick	$425	
Labor	240	
Fire-clay	8	
Cost per relining	$673	
Cost per year (average life, 6 months)—2 × $673		$1,346.00
Cost of relining one boiler with Thermolith:		
Fire-brick	$425	
Labor	240	
Thermolith	48	
Cost per relining	$713	
Cost per year (average life, 12 months)		713.00
Net saving in relining cost, per year		$633.00
Saving in operating time:		
Fire-clay takes 16 days per relining × 2	32 days	
Thermolith takes	14 days	
Operating days saved	18 days	
Annual allowance per boiler for depreciation, interest, maintenance, repairs, taxes, insurance, and general overhead—$4,900		
Corresponding saving, per year — $\frac{18 \text{ days}}{365 \text{ days}} \times \$4{,}900$		241.64
Total annual saving per boiler		$874.64
Total annual saving on 5 boilers (one used half time) $874 64 × 4.5		3,935.88

This saving amounts to over 18 times the cost of Thermolith.

When fire-clay was used to line the furnaces the linings lasted only from 5 to 7 months. By the use of Thermolith the life of the lining has been increased to one year. Each boiler was out of commission 32 days per year for relining when fire-clay was employed. The use of Thermolith has reduced this period to only 14 days. The latter lining sets at once and is ready for a fire as soon as the work is completed. Moreover, it has effectively prevented air leaks, as it makes a tight and strong bond as well as a durable lining.

Power Plant Depreciation Factors

THE chief factors entering into and causing depreciation in value are:

1. Wear and tear or amount and kind of use to which building or equipment is subjected.
2. Deterioration from age, neglect, or misuse.
3. Obsolescence.
4. Location, and effect of climate and other conditions of environment.
5. Damages from accidental, climatic, or other unforeseen conditions.

Factors that arrest depreciation are:

1. Care and attention given to building or equipment.
2. Maintenance and repairs.
3. Changes and alterations to prevent obsolescence.

All of these factors must be considered carefully when establishing and rechecking depreciation rates.

Because of the varying degrees in which these factors influence the life of buildings and equipment in different plants, it is impossible, generally, to fix a depreciation rate for any particular type of equipment that will apply in all cases. Neither is it practicable to fix a single depreciation rate to be applied to a plant as a whole. Variations in the factors affecting the plant's equipment make such an attempt unwise.

The various items of fixed assets must be classified into subdivisions so small that a single depreciation rate can be used accurately to write off the value during its useful life of each item contained in the subdivision. The degree of accuracy with which depreciation rates may be fixed increases as the size of the classification subdivisions decreases.

Table 1 gives depreciation rates and length of life for a number of items commonly found in power plants. Many of the items have rates that vary between wide limits. This variation measures the influence of the 8 factors mentioned before. In plants where they are most favorable the lower rate applies while the higher rates are used under most unfavorable factors.

To determine individual rates it is necessary to consider each item and determine the extent to which the factors affect its life. With this information a rate is fixed between the limits set which will give as accurate an estimate as possible of the depreciation accruing during each year of the life of the item.

TABLE 1. DEPRECIATION RATES AND LENGTH OF LIFE FOR A NUMBER OF ITEMS COMMONLY FOUND IN POWER PLANTS

Item	Depreciation Per Cent	Life, Years
Air compressors	4 – 5	20 –25
Alternators	4 – 5	20 –25
Belting	4 –12	8 –25
Blowers	5 – 6⅔	15 –20
Boilers—General	2½–10	10 –40
Firetube	7½	13
Watertube	5	20
Breaching and connections	3 –10	10 –33
Buildings—Brick	2 – 7	14 –50
Concrete	1½– 4	25 –70
Corrugated iron	10	10
Fireproof modern	2 – 4	25 –50
Frame	3 – 6	17 –33
Chimneys—Brick	3 – 7	14 –33
Steel	4 –10	10 –25
Chutes—Loading and unloading	10 –25	4 –10
Clinker grinding machinery	8⅓	12
Compressors—Air	6 – 7½	13 –17
Condensers	3½–10	10 –30
Converters—Rotary	3 – 6⅔	15 –30
Conveyors—Coal or ash	5 –10	10 –20
Cranes—Locomotive	9½–10	10 –11
Traveling	4½– 7½	17 –22
Engines—Gas	5 –10	10 –20
Oil	3½– 4	25 –30
Steam	4 –10	10 –25
Fans—Ventilating	7½	17
Feed-water heaters	3½– 6	16 –30
Fire extinguishers	10	10
Fuel economizers	4	25
Fuel oil equipment	4	25
Furnaces—Air	7½	17
Gages—Engine-room equipment	10	10
General gas appliances	8 –10	10 –12½
Generators	3 –10	10 –33
Hand cars	7	14
Heating and ventilating systems	4 – 6	17 –25
Hoists	7½–12½	8 –17
Hose—Fire	20	5
Hydrants	2 – 3	33 –50
Injectors—Boiler	10	10
Lockers—Steel	5	20
Meters—Electric	5 – 8	12½–20
Gas	4	25
Natural gas	20	5
Oil	7½	17
Steam flow	10	10
Water	5	20
Motors—Electric	4 –12½	8 –25
Pavements—Asphalt	7	14
Brick	4½	22
Wood block	3⅓– 5	20 –30
Piping—General	4 –10	10 –25
Air	5	20
Fuel oil	5 –10	10 –20
Water and steam	5 – 7½	17 –20
Covering	4 – 4½	22 –25
Plumbing	3⅓– 4	25 –30
Power-plant equipment	7½	17
Pumps	5 – 8⅓	12 –20
Shafting—Pulleys, etc	4 –10	10 –25
Shop furniture	10	10
Sprinkler systems	3 – 7½	17 –33
Stacks—Brick	3 – 7	14 –33
Steel	4 –10	10 –25
Stand pipes	1 – 2	50 –100
Steam-power plants	5	20
Steam separators	10	10
Steam traps	7½	17
Stokers—Fixed parts	5	20
Moving parts	20	5
Superheaters	3⅓	33
Switchboards	8⅓	12
Transformers	4½– 6⅔	15 –22
Turbines—Steam	2½– 6⅔	15 –40
Water	2 – 3½	33 –50
Valves—General	4 – 6	17 –25
Gate, brass	5	20
Gate, iron	10	10
Ventilating system	5	20
Wagons, dump and hauling	18¾	5½
Water-purifying plant	5½	18
Wiring—Electric	7½	17

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* Index number: 657.42 Depreciation.

Diesel Engine Operating Costs

INTERNAL combustion engines, particularly of the Diesel type, are being used more and more extensively as a primary source of power in many industrial power plants and as a secondary source of power in central stations. This has resulted from several factors. Probably the most important is that with considerably less investment than is necessary in installing a steam plant, an oil-electric plant can be placed in operation to give continuous, dependable service at low cost per delivered horsepower. A second factor is the assurance of ample fuel at reasonable cost, since it is a by-product of gasoline manufacture. Also, various fuel substitutes can be used with success.

These facts are generally known, but not so well known are the actual conditions under which Diesel engines operate economically, and the costs of operation compared with other types of prime-movers. Two Diesel engine installations in widely different fields will be discussed, and the results obtained may be considered as fairly typical of what may be accomplished in other fields.

The Dallas Oil and Refinery Company recovers oil from cotton-seed. In order to obtain the greatest possible recovery of oil it is necessary to use the so-called "hydraulic process," which includes a steam cooking of the meats before the oil is extracted. Since there is this demand for process steam it had been considered necessary to use steam for power also.

After careful investigation the company took what was almost a revolutionary step and installed a Busch-Sulzer Bros. Diesel Engine Company's plant to furnish power while the boilers were used only to furnish process steam. A 750 hp. 4 cylinder, 2 stroke-cycle Diesel was direct connected to a 312 kv phase 60-cycle, 480 volt generator which is used to supply power to all the motors in the plant as well as current for lighting and miscellaneous services.

For this particular installation it is necessary to have continuous operation for 144 hr. each week during crushing season, lasting about 10 months. During this time the daily load varies but averages 600 hp.

Fuel consumption is approximately 0.4 lb. per hp. hr. Lubricating oil used each 24 hr. is from 4 to 4½ gal. Power from the oil engine is costing not more than ¼ to ⅓ of what it cost formerly with Corliss steam engines and the company believes the 5 years of operation will return the entire investment through savings.

The Arkansas-Missouri Power Company has had an installation of McIntosh and Seymour Corporation Diesel engines in operation for some time. The following tabulation gives present generating costs as compared with costs of power with steam equipment.

The city of Woodward, Oklahoma, installed 2 McIntosh and Seymour Corporation engines about 2 years ago to replace an antiquated steam plant used for supplying electrical current to the city residents. The steam plant consisted of two 100 kw. steam turbines and two 250 kw. uniflow engines. An audit covering 395 days immediately prior to making the change from steam to Diesel operation gave the following daily cost figures: coal $119.05; fuel oil $8.56; packing and waste $1.58; maintenance and repairs $40. In addition 19 permanent men and 2 part-time men were required to operate the plant.

Index Number
658.261 Power generation
621.434 Diesel engines

With the Diesel engines there were installed several other new pieces of equipment, such as a new switchboard and pumping plant. These undoubtedly have had an effect on the very good showing made by the oil engines, but the city authorities are convinced that it is only in the degree of improvement resulting.

TABLE 1. ARKANSAS-MISSOURI POWER COMPANY. CALCULATION OF POWER GENERATION COST PER KW HR.

	STEAM	DIESEL
Boiler-room	$375.00	0
Fuel		
Coal	2,563.36	....
Oil	....	$851.20
Unloading coal	20.00	0
Wages, including ice pullers	444.95	287.77
Lubrication, waste, etc.	158.77	175.15
Total	$3,561.98	$1,314.02
MAINTENANCE		
Building	0	21.47
Boilers	36.75	....
Engines, including spares	9.40	356.40
Tools	10.51	0.82
Total	$3,618.64	$1,692.71
Kw. hr.	60.000	181,420
Production cost per kw. hr. cents	6.03	0.94

In place of the steam plant two 520 hp. McIntosh and Seymour Diesel engines were installed with the necessary water cooling and fuel oil tanks. They are producing more current than was produced by the steam plant. Fuel oil costs less than $15 per day; lubricating oil costs less than $1.50 per day. The power plant personnel has been reduced from 19 to 7.

A 2 hr. test was made for the express purpose of determining the relative economy of Diesel engine operation. It was conducted under an average load on the generator of 250 kw. and gave the following results:

Fuel-oil used	19.2 gal. per hr.
Cost	67.2 cents per hr.
Cost per kw. hr.	0.0027 cents
Lubricating-oil used	58 lb. per hr.
Cost	5.3 cents per hr.
Cost per kw. hr.	0.0002 cents

Although they have no direct comparison of costs of the two plants a general comparison can be made which is quite favorable to Diesel engine operation. During the first year of oil engine operation savings were made approximating the cost of one of the new engines. The cost of current was materially reduced and even then the city authorities expected to be able to make substantial payments to their sinking fund through increased earnings from the oil engines.

Power Plant Personnel

Selection, Training, and Promotion of Steam Power Station Employees

By K. W. STILLMAN

Associate Editor, Management and Administration

THE production problem with which central stations are confronted is a particularly difficult one. Although the average demand for power and current can be estimated with considerable accuracy the variations between peak and low loads are very large and cannot always be foretold. A dark day causes a greatly increased demand for current for lighting purposes in homes, shops, and offices. Production requirements of factories for which the central station supplies power may double for a short time the amount of power ordinarily required.

These are but examples of the many factors which influence the demand for the central station's product but which it is impossible to anticipate with any degree of accuracy. But these increased demands must be met, and at the particular time required. The average manufacturing plant is required to schedule its output and keep reasonably close to that schedule in its production if it is to succeed. It is given a certain grace period, however, by which it can fall behind its plan of output without seriously affecting its reputation. A central station has no such leeway. Its product has nearly 100 per cent time utility. Current to light factories during a dark day is useful only if supplied that day. The failure to supply power at the particular time it is needed means a total failure of service because "tomorrow" or "in a few days" will be too late.

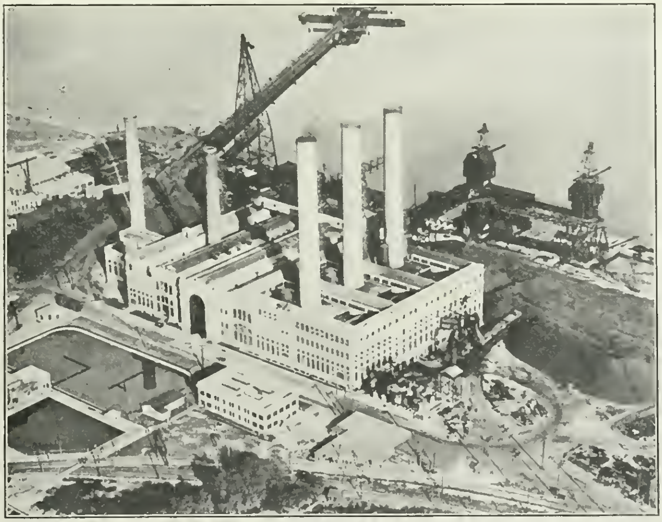

Fig. 1 Airplane View of the Westport Steam Power Plant, Consolidated Gas, Electric Light and Power Company of Baltimore

Because of these difficulties with which the operation of central power stations are surrounded, it will be valuable to industrial managers to learn how these plants are operated. In order to meet the exacting demand made upon them, central stations must, of necessity, have developed highly efficient organizations — more so, possibly, than power plant organizations in industries where the perfect functioning of power production processes is not of such great importance.

Index Number
658.3 Personnel management
Index Number

Power plant equipment has been discussed elsewhere in this issue. This article will deal with the men who must run that equipment. The Consolidated Gas Electric Light and Power Company of Baltimore has been taken as an example of a central station that has developed an exceptionally well trained and efficient power plant organization. The methods used by that company in training its steam station operatives will be given as an illustration of what may be done by manufacturing executives to build up a group of workers that will produce equivalent results.

Vacancies are filled from within the organization whenever possible, and that is nearly always. As will be discussed more fully later they are actually *filled.* Instead of an employee being given a better job which the management *hopes* he can handle successfully, a man is placed in the vacated position, who has been in training for that particular job for years. He has held other jobs that provided him with experience needed on the new job and he has been encouraged in taking various educational courses that would assist him in his new work. When he is promoted, the management is as sure as anyone can be when dealing with human beings, that he is capable to do the work required of him and that he has had the necessary training and experience to do it successfully.

The necessity for this promotion may set in motion others down the line until the actual replacement for the loss that caused the original vacancy will take place in the ranks of the helpers on jobs of lowest rating. A Help Requisition is sent to the Employment Department for a worker to fill the ranks of the plant personnel.

This requisition is filled from an Occupational Description or job specification. Every job in the plant has been analyzed and a complete description of it prepared. Items of information considered essential are the rate of pay, working hours, duties and responsibilities, personal qualities desired, working conditions, education and experience necessary, opportunities for advancement, and sources of supply. (See Fig. 2.) These descriptions are kept up to date by constant revision in order to keep pace with the changes that are always taking place in the operating procedure of any progressive organization.

With the Occupational Description of the job before him the Employment Department representative has a definite picture of the man required for the job and is in an excellent position to hire a man who will be satisfactory.

Educational requirements have been placed very high. There are 43 jobs specified for the Consolidated Company's steam station and qualifications for all but 4 include a grammar school education. This requirement is not because the work new employees will be given can be done only by grammar school graduates but because the management is looking to the future.

Consolidated Gas Electric Light and Power Company of Baltimore
OCCUPATIONAL DESCRIPTION

NAME OF OCCUPATION. . . Office Boy. . . B. . . SYMBOL. . 1550. . DATE. . 9/26/21 . . . . .
OTHER NAMES. . . . .
NAME OF DEPARTMENT. . Financial Dept. . . . SYMBOL. . . 180. . PREPARED BY. . . . . JNM . . . .

Pay	The employment salary for this position is $6 per week.
Hours	8:30 A.M. to 5:00 P.M. Monday to Friday, inclusive. One-half hour for lunch. 8:30 A.M. to 1:00 P.M. Saturday.
Duties and Responsibilities	The Office Boy places the Company's endorsement on all checks, using a machine. He also uses a patent machine which stamps the *amount* on dividend checks. All mail coming into the department is stamped, showing the time it is received and distributed by him to those for whom it is intended. He also files "Statements" and other papers in "Grip Binders." The Office Boy assorts coupons consecutively according to "Series numbers." Each coupon period of each bond issue has a "Series number" and the coupons are numbered within the "Series." When the cancelled coupons are received they are assorted in the manner outlined above. In addition to the above-mentioned duties, the Office Boy frequently executes errands to the different departments. He is required to give Bond of $2,000.
Personal Qualities Desired	A Boy between the ages of 14 and 16 years is desired. He should have a neat appearance because his errand duties necessitate him circulating among the executive offices of the Company. Accuracy is required in the assorting of coupons according to series and number.
Working Conditions	The Financial Department is located on the 18th floor of the Lexington Building and the office is well lighted and ventilated. A small desk with the necessary appurtenances is supplied for the use of the Office Boy. The work involves considerable standing and walking around the department and to other departments of the Company.
Education and Experience Desired	No former experience is necessary. An 8th grade education or its equivalent is desired, in order that the Office Boy may be able to perform the filing and assorting and the stamping of checks as called for in his duties.
Opportunities for Advancement	This position furnishes promotion to Burroughs Bookkeeping Machine Operator.
Sources of Supply	The Public Schools are a source of supply.

FIG. 2 EXAMPLE OF OCCUPATIONAL DESCRIPTION PREPARED GIVING ESSENTIAL INFORMATION ABOUT EACH JOB

In 4 jobs men are hired for that work alone. The work is of such nature that it can be done by a low type of workman and no promotion is offered. Employees in all other occupations are potential superintendents, and a grammar school education, at least, is considered to be a necessity for a man in an executive position. A man who is employed as a general helper or as an oiler is not allowed to stay at that work long. He must advance. The steam station management has adopted the idea that to stand still is to retreat. When an employee becomes satisfied with his present work to the extent that he is no longer interested in advancement, the management loses its interest in him and no obstacles are placed before him if he should wish to leave. An interesting sidelight on the stress placed upon education is the fact that 10 per cent of the present working force are college graduates.

If an applicant meets the educational and other requirements listed in the Occupational Description, the work which he would have to perform is explained to him orally and pictorially. Since most of the men hired are quite inexperienced, they have little conception of what they will have to do. By means of photographs explained by the Employment Department representative an attempt is made to give the applicant a complete picture of the job. Neither its advantages nor its disadvantages are emphasized—the aim being to give an accurate view of what the job comprises.

After this demonstration, if the applicant believes the work would be agreeable, he is sent to the steam station. Here he is given a practical demonstration of what he will have to do. He may be shown and asked to operate the lever used for dumping ashes and will be told how often he will have to do that. He may be given a long bar and asked to stand in front of an open furnace door and manipulate the bar inside the furnace and he will be told the number of times a day he must do this. He may be asked to climb about the boilers because the job he is seeking necessitates such activity.

By means of such demonstrations each applicant acquires an idea of what he will have to do and can decide whether or not he will like it. The net result of all this time spent on an applicant is that labor turnover caused by ignorance of the work and subsequent employee-dissatisfaction has been practically eliminated.

Careful selection of employees has a direct influence on the operating costs of the plant in addition to building up an organization of ambitious men capable of and anxious for advancement. At the present time 15 stoker operators are employed. About 1500 tons of coal are used daily so that each operator handles about 100 tons of coal a day. At $5 a ton this is equivalent to $500 of the Company's money that each operator is responsible for burning each day. If, by reason of his higher intelligence and better training, he can increase the efficiency of his work 1 per cent, he can effect a saving of $5 a day in fuel costs.

That such increase of efficiency is possible and has resulted is evidenced by the work of the ash-removing gang. During 1918 when about the same amount of coal—1500 tons—was burned as at present, 75 or 80 men had all they could do to remove the accumulation of ashes. Today, with the same mechanical equipment, 11 men handle the work easily. Even after allowing a 50 per cent reduction in the amount of ash per ton of coal now compared with 1918, because of improved quality and firing methods, this still shows a reduction in the working force of 70 per cent, due entirely to higher grade workmen and better methods of utilizing their efforts.

Each new employee is treated as an individual in the scheme of promotion used. Because the growth of cities and industries is fairly regular, central stations can foretell with considerable accuracy the future average demands for their product. When an employee is taken on he passes through a sort of probationary period during which both he and his work are carefully watched to see if the expectations which the management had of his ability have been realized. If he measures up, a plan of advancement is prepared for him so that the power plant management knows definitely just where he should be in 5 years.

His entering qualifications and subsequent progress show his suitability for a certain class of work and he is unknowingly aimed at a responsible position in that work. From his first job as an oiler, a boiler cleaner, a general helper, or what-not, he is advanced to and through jobs that will better equip him for that distant goal that the management has set for him. He learns each job thoroughly. He is not hurried, on the contrary, his progress may often be slower than he believes is necessary. When he is advanced, however, he is equipped, in both training and experience, to handle his new work capably.

As a general guide for laying out the promotional sequences for employees a promotional chart has been constructed. (See Fig. 3.) The sequences shown there are not followed rigidly. The power plant management has felt that it is much more satisfactory to build a job around a man than to try to mold a man to fit a job. For this reason the particular qualifications of some employees have occasioned radical departures from the promotional sequences shown on the chart.

The activities and records of employees are kept by means of two devices. One is a history and record

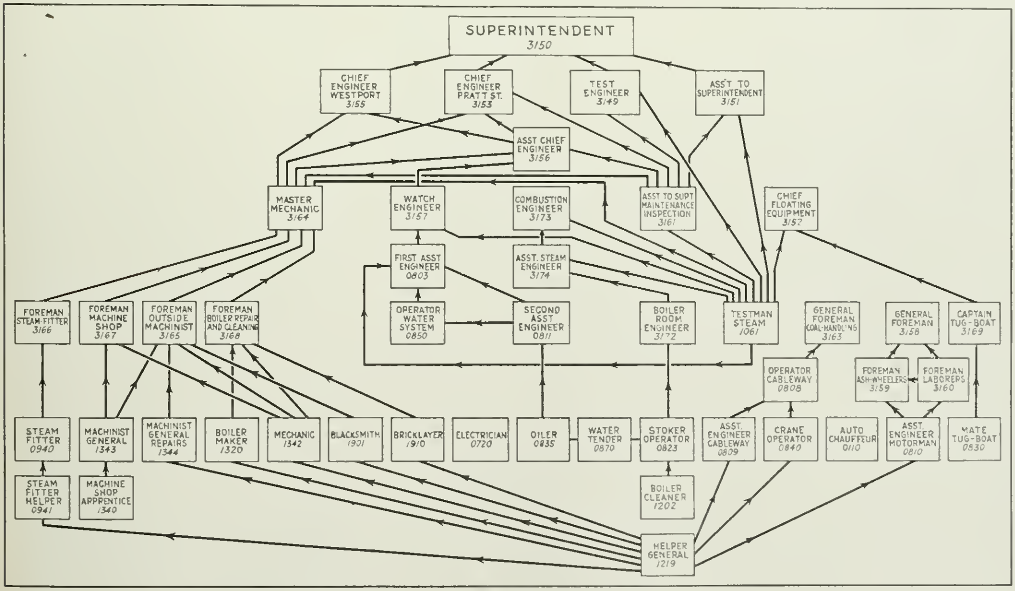
SUPERINTENDENT 3150
CHIEF ENGINEER WESTPORT 3155
CHIEF ENGINEER PRATT ST. 3153
TEST ENGINEER 3149
ASS'T TO SUPERINTENDENT 3151
ASST CHIEF ENGINEER 3156
MASTER MECHANIC 3164
WATCH ENGINEER 3157
COMBUSTION ENGINEER 3173
ASST TO SUPT MAINTENANCE INSPECTION 3161
CHIEF FLOATING EQUIPMENT 3152
FIRST ASST ENGINEER 0803
ASST. STEAM ENGINEER 3174
FOREMAN STEAM-FITTER 3166
FOREMAN MACHINE SHOP 3167
FOREMAN OUTSIDE MACHINIST 3165
FOREMAN BOILER REPAIR AND CLEANING 3168
OPERATOR WATER SYSTEM 0850
SECOND ASST ENGINEER 0811
BOILER ROOM ENGINEER 3172
TESTMAN STEAM 1061
GENERAL FOREMAN COAL-HANDLING 3163
GENERAL FOREMAN 3158
CAPTAIN TUG-BOAT 3169
OPERATOR CABLEWAY 0808
FOREMAN ASH-WHEELERS 3159
FOREMAN LABORERS 3160
STEAM FITTER 0940
MACHINIST GENERAL 1343
MACHINIST GENERAL REPAIRS 1344
BOILER MAKER 1320
MECHANIC 1342
BLACKSMITH 1901
BRICKLAYER 1910
ELECTRICIAN 0720
OILER 0835
WATER TENDER 0870
STOKER OPERATOR 0823
ASST. ENGINEER CABLEWAY 0809
CRANE OPERATOR 0840
AUTO CHAUFFEUR 0110
ASST. ENGINEER MOTORMAN 0810
MATE TUG-BOAT 0830
STEAM FITTER HELPER 0941
MACHINE SHOP APPRENTICE 1340
BOILER CLEANER 1202
HELPER GENERAL 1219

FIG. 3 PROMOTIONAL CHART USED BY THE MANAGEMENT AS A GUIDE IN ADVANCING EMPLOYEES

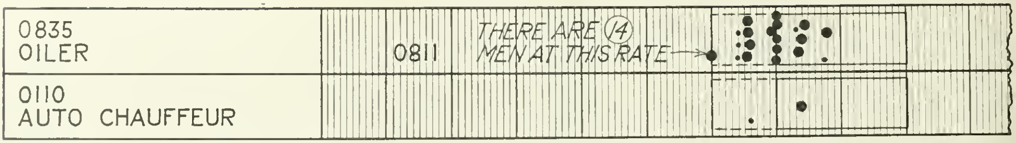

FIG. 4 SAMPLE STRIPS FROM CONTROL CHART SHOWING HOW EACH STRIP IS PREPARED

card similar to records kept of employees by nearly all modern business concerns. The second device is unique. It is a control chart or spotting board upon which every employee is represented by a small map pin.

For each occupation a strip of paper was prepared as shown in Fig. 4. A blank space at the left provides a space for the occupational title and the code number by which it is designated. Two ½-inch spaces to the right of this contain code numbers of jobs next in line of promotion and other pertinent data concerning the occupation. The rest of the strip is divided into 20 sections by heavy lines and each section is sub-divided into 10 parts. These are used for plotting the wage scales for the occupation. Each section represents $2 a week or 5 cents an hour. The maximum and minimum wages decided as appropriate for the occupation are spotted on the strip and a rectangle drawn to show the wage range. The median wage is represented by a vertical line drawn in different colored ink through the middle of the rectangle.

Each strip is mounted on thin cardboard. Shallow drawers equipped with spring clamps to hold the strips in place are provided and the various strips are placed in them in the order of importance of the positions represented. (See Fig. 5.) At the top of each set of strips is placed the department name and the wage scales. Two scales are used—the upper one representing hourly rates, and the lower, weekly rates. To avoid confusion in determining which scale should be used, the hourly scale and the titles of all occupations so rated are entered in red ink while black ink is used for weekly rates.

Every employee is then represented on the chart by a map pin fixed in a line with his occupation and below his wage rate. When there are more workers in an occupation at the same wage rate than can be represented by individual pins, a single pin is inserted from which an arrow leads to a large white-headed tack on which is written the number of employees represented by the pin. (See Fig. 4.)

The master file of control charts is kept in the Employment Department. Photostats of them are taken at frequent intervals for use by the power plant management. These copies, together with the employee's record card and Occupational Descriptions, furnish the management with very valuable data concerning the personnel. They show the relationship of each man to his job, to his wage, and to his fellow workers. All questions of pay increases, promotions, transfers, and similar personnel changes can be studied intelligently and accurate decisions made.

Briefly, the Consolidated Company's method is to carefully select high-grade employees and then train them for successively higher jobs. The quantity and quality of work obtained from such men is convincing proof that the methods pays.

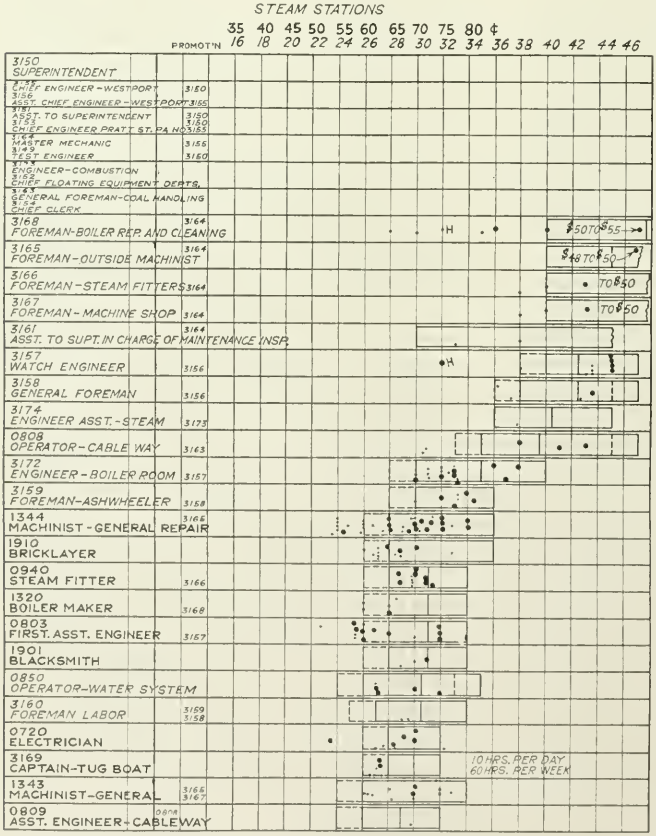

FIG. 5 STEAM STATION CONTROL CHART
Every employee is represented by a pin opposite his occupation and under his wage rate.

Factors in Industrial Plant Location

By P. F. WALKER

Dean, School of Engineering, University of Kansas

Index Number
658.21 Plant location

Failure to recognize and consider all the factors affecting proper plant location may seriously influence profitable operation of the enterprise. In this article Mr. Walker discusses, authoritatively, the economic factors that must be considered. The discussion is sufficiently broad in scope to cover the entire industrial field but is specific enough to be of real practical value to concerns that contemplate either a new plant or a change in location of their present one.

FOR the smaller communities it is to be expected that the establishment of a new enterprise will mean the influx of workers attracted by the opportunity thus afforded for employment. Some skilled workers may be brought at the start by the management. In such cases the points which form the topic for the following paragraphs are of special significance.[1]

Civic activities of a town are of real significance whatever the size and nature of its industries. In recent interviews which the writer has had with members of various civic organizations the point has been repeated again and again. These interviews have included groups in cities varying in population from five thousand to one million. Without exception there has been intense interest and evidences of sustained activity in promoting the welfare of the city. Industrial development has become an object of more than simple desire for more business. The presentation of reasons for additional plants has taken a form that is far in advance of ideals current only a few years ago. The study of conditions has been systematized and the attractions made more fundamental in character. It would appear that the industrial idea has taken root in the American community. Furthermore, it is apparent that civic organizations are more intelligent in their efforts. The members appreciate more fully the basic factors in industry, and realize that mills and factories rest on a human foundation. This means that all of them are stressing the attractive points in their towns; well kept streets and parks, schools, playgrounds, churches, and all forms of public enterprise.

It is not to be forgotten that the first point of favor in an industrial town is the condition of its industries. Comparisons may not be in keeping with prudence, but it can do no harm to contrast appearances in certain mining communities. Everyone knows the typical coal mine with its ugly structures and the all-too-common group of shanty dwellings that house the workers, all worked into a dreary landscape of desolation and despair. In contrast with this scene one may see in the coal mining district of the Tennessee Coal and Iron Company, just north of Birmingham, Alabama, attractively laid-out villages that are most pleasing to the eye as well as to one's sense of proper living. Schools, churches, community houses, playgrounds, and neatly ordered streets, with shrubbery and flowers planted in taste even around the mine structures themselves, combine to give an air of comfort and community solidarity. No one would hesitate in choosing the place as most desirable in which to work. In all parts of the country the standards of industrial architecture are advancing, with emphasis on light and comfort as proper adjuncts to an increased effectiveness combined with the best good to the workers. Observations made within the last year in more than 50 of the leading industrial cities confirm the writer in this statement.

It is a wholesome circumstance that the American people are coming to realize that civic beauty and substantial forms of community aids to correct living are elements in industrial progress. The idea is sound and cannot help becoming a factor in the localization of industries. People do not need to work and live under depressing influences. Light and air while working, and attractive districts for living are entirely feasible. The community has its part to do in bringing them to pass, and it is rising to its task with spirit in many cases, and is proud of the fact. The very large city has a restricted opportunity for expression in these lines of civic improvement which extend into the lives of the average worker in industry. In the fields of literature, science, art, and the drama the city can do much for those who are in position to avail themselves of the opportunities, but to the mass of workers in the ranks of industry there is not so much that is tangible among these attractions of the metropolis. The smaller community has the more direct touch.

Power and the other utility services are items of importance which sometimes cast the deciding vote on location. It depends upon the type of enterprise, however. Where power in its direct mechanical forms is the only form of service in demand, the central power distributing system, so situated as to offer low rates, is a powerful influence. This is the case with many metal manufacturing enterprises, and others producing goods in leather, fabrics, lumber, and many miscellaneous lines. With the development of the electric furnace and electrolytic processes of refining various metals, cheap power has become a leading factor in several basic industries. It has entered prominently into the movement of the cotton mills in the southern states, where building heating demands are relatively light and the more elaborate dyeing processes are not applied to the fabrics.

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[1] This is a continuation of an article appearing in Management and Administration, September 1924, p. 259.

In many other forms of manufacturing the demand is largely for heat, both in process work and for general heating and drying. Here the element of significance is fuel supply. In many cases the required power is developed at small additional cost, exhaust steam from the engines being utilized for the heating and other services in the plant. To apply the test of correct analysis in determining the conditions when this situation obtains, one must have full knowledge of the process requirements, and of standard equipment and practices in power service. Accurate data are necessary on coal prices and freight rates. Cheap natural gas and petroleum deposits have drawn many industries to relatively remote points, sometimes wisely and sometimes unwisely. An enterprise not requiring heavy permanent investment, and for which cheap fuel is an especial incentive, may do well even on a relatively short term of operation. For a more extensive installation, however, the analysis should be made on the basis of coal. If it can prove out on that basis, then the advantage of a cheaper fuel during the years of building up of good business connections is very helpful, and may become properly a deciding factor.

Importance of Adequate Water Supply

Water supply is always important and sometimes vital. When large power developments are necessary, the quantity of water available is the vital element. A city with ambitions toward extensive expansion of its industries must look well to this point. The limit of development for some communities is being reached today. In other cases it is quality of the water which may determine the choice of location. For instance, a corn products plant, to manufacture glucose syrups, is particularly sensitive to the presence of sulphur in the water. It causes clouding of the product. Soft water is necessary for leather tanning and many other processes. The ease with which the natural supply may be softened figures heavily in such instances. Water is always an object of study in any investigation of conditions.

Distribution cost of the manufactured article is, after all else is said, the determining element in location of any industry of a general nature. It is associated closely with marketing consideration—so closely that one may not be considered separately from the other. If the market territory is fixed, the location must be found from which the cost of distribution will be a minimum. If the location is fixed, the market territory must be selected from which cost of distribution will be advantageous with respect to competing producers.

An analysis requires first a complete tabulation of freight rates on a standard unit of product, from the point of shipment to every important point of delivery within the market territory. These rates are the ones actually in effect under the existing rate structure. It should be observed that under such a modified rate structure as was suggested in the earlier discussion of an ideal industrial system, the rates to delivery points would tend to favor production near at hand, from which the shipments would average to a minimum distance. This result might not follow under the present régime, especially if one of the points under consideration was so placed as to give it the advantage of rates in competition with some established water route.

The second step in the analysis is to establish a basis for estimating the quantity of goods shipped to the several important delivery points. The simplest method is to take the population of each of the local marketing districts represented by the typical delivery points, considering these as retailing districts for the goods. This was referred to when the estimating of the absorbing capacity of markets was under discussion. For the second illustrative analysis which follows, the index of quantity of shipment of the article in question—machinery, crated—is the amount of capital invested in industrial enterprises within the district represented by the city at point of delivery—100 lb. for every $10,000 invested capital. This is on the assumption that the amount of machinery that will be sold in a community has a relation to the amount of equipment already employed in production, of which capital is the nearest measure obtainable. Whether this is a good unit for estimating the amounts of shipments is open to discussion. For some classes of goods it would appear to be better than population direct. Various specialized products, destined for sale among specific portions of the population or among certain industries, would have laws of variation of demand quite independent of other products. Coal tar dyes, for example, would go to textile centers. Whatever basis of measurement of demand may be selected as most fitting, when once determined upon it must be followed out with care, and the amount of shipment to each distributing center in the trade territory calculated.

With quantity of shipment thus estimated on relative basis, and the freight rates to the several distributing points known, the final step is to calculate the costs of shipment. Two or more assumed points of production are to be compared. For each of these the costs of shipment are totaled and the total cost divided by the total shipment. The result is an average freight rate or an index number giving the point from which distribution is possible at the lowest cost. If production costs are the same for all of the manufacturing points under consideration, this distribution index gives the answer as to which is the most economical location for the industry. If production costs differ, then the index number is added to the cost of production of the unit quantity of output and these results compared.

Illustrations of Distribution Cost Analysis

Two calculations will be shown, comparing conditions of shipment from three typical cities which are near the center of manufacturing of the country. These are Buffalo, Detroit, and Cincinnati. Each city is distinguished as a center of production. Each has a metal products specialty: Buffalo—forgings, foundry products, and heavy machinery; Detroit—automobiles; Cincinnati—machine tools. Each has a considerable line of varied manufactures in addition to the specialty. Each is on a water transportation route which has some influence on rail rates to certain points. In this Buffalo has an advantage, in that it is a more important breaking point for transcontinental freight, where lake freight changes to rail or canal barge on its way to New York and other Atlantic seaboard points. Cincinnati has an advantage in low fuel cost, due to its location with reference to the rich coal fields, but this will not show to advantage on a pure distribution cost calculation. Such an advantage will have effect when production cost is added, but Buffalo again comes into advantage by reason of Niagara power which will offset cheap fuel for those industries not calling for heat in process.

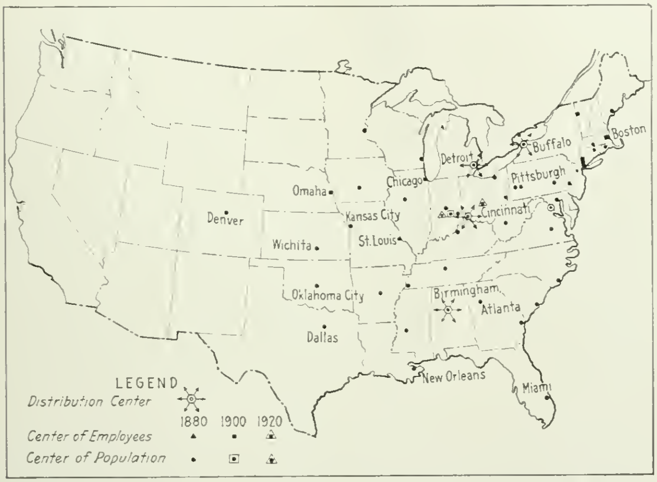


FIG. 1 CENTERS OF DISTRIBUTION EAST OF THE ROCKY MOUNTAINS

The centers of distribution are the cities shown on the map. (Fig. 1). They represent the entire country east of the Rocky Mountains, including Colorado. All of New England goes under a single rate, and hence is treated as a unit. In a few states two different cities are used, these being New York, Pennsylvania, Ohio, Georgia, Illinois, Missouri, and Tennessee. In each of these, one of the cities is on the coast, lake, or navigable river, while the other is inland. Where this division is made the state is divided between the cities, when making up the figures for population or invested capital, used as units for estimating quantity of shipments. In some cases state lines are not followed closely, as for Pittsburgh where several Ohio and West Virginia cities are included within the local distributing territory. For cities more distant from the producing points, entire states are considered as if centered at their representative towns. Only the larger cities are included in the population figures, however, not entire state populations. Much time has been spent in assembling these figures which are used to measure quantity shipped.

In the first illustrative calculation the article used is "knit-goods," and the quantity shipped is taken according to population. (See Table 1). The latter figure is modified for cities in the southern states, on account of the high proportion of colored people, who are assumed not to purchase so heavily as whites. The factor used is 80 per cent. If the purpose in view were to make an accurate investigation of the knit-goods industry it would have been better to compare three producing points like Philadelphia, Chattanooga, and Kenosha, Wisconsin, which are more important centers of production in this line than are the three cities chosen, but the real purpose at this time is simply to illustrate the method of analysis. It happened to be more convenient to secure freight rate data for these particular cities, which were selected because of their central location.

In the second calculation the article used is "Machinery Crated," including such commodities as medium weight engines, generators, machine tools, and miscellaneous machinery. The quantity shipped is taken in proportion to the amount of capital invested in manufacturing industries in the several distributing areas, as given in the United States Census reports. (See Table 2).

In both calculations it is assumed that 100 lb. of product is shipped per thousand of population in the first, and per $10,000 of invested capital in the second. In the tabulations, the figures entered in the columns headed "Demand Factor" express the number of "hundreds" of pounds of goods shipped to the distributing centers. The rates are L. C. L. (less than car load lots). Wherever lake rates, or combined rail and ocean rates are less than the all-rail rates, the lowest are used. With these explanations the following tabulations are readily interpreted.

The results of the preceding calculations are not so much in favor of Buffalo as might at first be assumed. Should all manufacturers go to that city, the cost of production would be affected so that advantages in distribution cost would be nullified. But the chief point is that very few individual plants sell to all parts of the country. One of the chief reasons for making such a general calculation is that it gives a basis for the selection of the marketing territory to which a company in any city may ship at cost lower than that for any other. From the list of cities, which represent states in large part, in the list of distribution centers given in the tabulations, a Cincinnati company can select a large territory to the South and West which it can reach cheaper than can a Buffalo company. So it is with Detroit to the West and Northwest. As before noted, a small difference in production cost will offset the difference in shipping cost, the latter being so much less in total than the former.

Another point emphasized by the calculations is the extent to which the existing freight rate structure favors the older established centers. Buffalo is a long way east of the center of population, which is in Indiana, but still it can reach the people of the country cheaper than can Cincinnati, which is only a few miles east of the population center. In making this statement it is assumed that the Pacific coast states are included, in which case, as noted above, the water rates via the Panama Canal would contribute to the margin enjoyed by Buffalo. This situation is not necessarily bad, since it is only just that water rates should have their due influence in lowering the average cost of transportation for the country as a whole. Probably the extent of this lack of balance now caused by rail rates alone would be diminished, however, by any likely change made in the rate structure in the future.

TABLE 1. COMPARATIVE COSTS OF DISTRIBUTION OF KNIT-GOODS FROM BUFFALO, DETROIT, AND CINCINNATI[1]

DISTRIBUTION CENTERS			BUFFALO		DETROIT		CINCINNATI	
Name	Population	Demand Factor	Rate	Shipping Cost	Rate	Shipping Cost	Rate	Shipping Cost
New England	3,931,877	3,932	0.84	3302	1.180	4630	1.305	5131
New York	7,364,906	7,365	0.795	5859	1.110	8180	1.235	9100
Buffalo	1,173,387	1,173	0.000	0000	0 680	798	0.945	1108
Trenton	827,113	827	0.795	658	1.110	918	1.235	1021
Philadelphia	2,564,936	2,565	0.795	2039	1.09	2796	1.215	3117
Pittsburgh	1,216,244	1,216	0.760	924	0.835	1015	0.835	1015
Baltimore	1,229,298	1,229	0.795	977	1.080	1327	1.205	1481
Richmond	489,351	391	1.065	413	1.08	422	1.205	471
Charleston, W. Va.	117,654	117	0.975	114	0.87	102	0.730	85
Wilmington	110,168	88	1.205	106	2.045	180	1.255	110
Charleston, S. C.	105,481	84	1.295	109	2.130	179	1.340	113
Savannah	135,800	109	1.295	141	2.130	232	1.340	146
Atlanta	284,731	228	2.220	506	2.300	524	1.520	344
Tampa	203,772	163	1.760	387	2.830	461	2.040	329
Birmingham	283,047	228	2.160	493	2.270	518	1.510	344
Nashville	254,055	203	1.570	319	1.710	347	1.040	211
Memphis	162,351	130	1.620	210	1.620	210	1.360	177
Louisville	362,863	290	1.045	306	0.900	261	0.565	164
Cincinnati	918,070	918	0.945	868	0.790	726	0.000	000
Cleveland	1,559,941	1,560	0.710	1107	0.665	1037	0.775	1209
Indianapolis	711,217	711	0.965	686	0.790	562	0.565	402
Springfield	320,623	321	1.165	374	0.920	295	0.850	273
Chicago	3,008,694	3,009	0.760	2285	0.660	1985	0.805	2421
Detroit	1,714,621	1,715	0.680	1166	0.000	0000	0.790	1355
Milwaukee	759,819	760	0.975	741	0.835	634	0.900	684
Minneapolis	714,197	714	1.680	1200	1.500	1071	1.620	1157
Des Moines	411,521	412	1.710	704	1.490	614	1.335	550
Omaha	246,548	247	2.160	524	1.840	454	1.335	550
St. Louis	879,295	879	1.225	1077	1.005	884	0.850	748
Kansas City	533,428	533	2.160	1151	1.840	981	1.685	898
Wichita, Kan	151,199	151	2.740	414	2.590	391	2.280	344
Oklahoma City	193,647	194	2.740	532	2.500	502	2.280	442
Little Rock	94,012	75	2.370	178	2.215	166	1.910	143
Dallas, Tex	840,845	672	2.995	2011	2.848	1912	2.535	1703
New Orleans	431,093	345	1.595	550	2.135	736	1.870	645
Denver, Colo	329,646	330	3.695	1215	3.465	1143	3.310	1092
Totals	34,635,411	33,844		33,456		37,193		38,949
Index Number			0.990		1.097		1.149	

[1] Reducing the Index Numbers to the basis of unity for the lowest, that for Buffalo, we find for Detroit 1.107, and for Cincinnati 1.159. What this means is that a plant at Buffalo can deliver to the particular marketing territory here taken with a margin of 11 per cent under Detroit and 16 per cent under Cincinnati. This margin is not to be overestimated as to significance. Freight charges on product are not large in comparison with production cost so this margin is applied to but that smaller portion of total cost. It has significance, however.

The Shifting of Industries

In the United States during the last 50 years there have been many notable shifts in the location of various industries. Certain tendencies are discernible — many movements toward the West and South. Detail studies have been made for 18 basic industries—cotton goods, woolen goods, leather goods, paper and wood pulp, boots and shoes, tanned leather, men's clothing, starch and glucose, iron and steel works, foundry and machine shops, cement, furniture and refrigerators, brick and tile, agricultural implements, dairy products, flour mills products, slaughtering and meat packing, pottery, terra-cotta and fire clay. In 1880 the center of employed population in these industries was on a meridian a few miles east of Pittsburgh, Pa. In 1900 the center was a little West of Wheeling, West Virginia, and in 1920 it was approximately on the line of Cleveland, Ohio. As seen on the map given in connection with the analysis of distribution expense, these centers appear in much the same relation as does the westward movement in total population of the country.

There are various causes to which may be attributed this movement. The most notable is the shift in population. The effect is so apparent that there is no necessity for entering into an analysis of the reasons, further than to note that accessibility to growing markets has caused many establishments to be relocated, and new establishments to be located at points facilitating the movement of products into those regions which have been growing most rapidly. The rapid development of the Pacific coast states is the strongest single factor. On the West coast there is going on a marked increase in manufacturing industry, due partially to a natural spirit of enterprise on the part of the people, and partially to delays in transcontinental traffic. While this latter statement does not appear to harmonize with the transportation advantages coming from the opening of the Panama Canal, nevertheless it was true that during the whole of this period which is under consideration, difficulties of this sort were encountered and many industries have been established to meet the needs of the rapidly growing population. Some of these industries have utilized materials which were available locally and in more recent years the influence of the California oil fields has been marked.

The opening up of oil producing territory, both in California and in the mid-continent field of Kansas, Oklahoma, and northern Texas, has had a secondary as well as a direct effect. That is, in addition to making available a supply of cheap fuel, the oil business itself has stimulated activities in many lines and brought about a marked growth in population. This increase in population has had the simple effect of creating greater local marketing opportunities, so that the general movement in those directions has been augmented. Certain specialized industries, such as zinc smelting, glass manufacturing, and, to a limited extent, portland cement and other ceramic products have tended to move toward these centers of cheap fuel, especially where natural gas has been developed in large quantity.

Another important influence is in the nature of a combination of personal initiative and the development of water powers of large magnitude. While the possibilities of such power have always existed, it required the positive action of men who recognized the possibilities and had faith in the ultimate future of the region.

The movement of the cotton milling industry into the southern states illustrates this point. For many years it had been recognized that unnecessary transportation expense was involved in the movement of raw cotton to New England, especially where the growing demands of the West and Southwest called for the reshipment of manufactured goods in the reverse direction. For many years it was uncertain whether the character of labor available in the cotton belt would make it possible to develop the milling industry. When the move was finally made, however, it was found that the handicap was readily overcome and there has resulted the notable developments of this basic industry, made possible by the power developments on the rivers of North and South Carolina, Georgia, Tennessee, and Alabama. It may not be said that any one influence was the controlling element, it being true that it required a combination of courage and enterprise on the part of the men who were leaders in the movement, and the possibilities of power. Joined with these there are also the elements of saving in transportation charges and accessibility to an important marketing area.

Economy in transportation, already suggested in the preceding paragraph, has had its direct effect. This has been brought about through two conditions. One is the actual saving brought about by stopping the movement of raw material on its way to the point of manufacture, thus reducing the gathering charge on the materials, combined with the opportunity for shipping the finished product into the marketing area, reached more readily from the new point. On the freight differential thus established, many industries have been made possible. A good illustration of this is furnished by a steel manufacturing plant in Kansas City. This plant is operating on the process by which scrap from the agricultural and oil producing territories west of the Missouri River is the primary material. This material, instead of being shipped back to points farther east, is manufactured into medium grade steel which supplies a market in the West. This plant thus enjoys a differential of from $6 to $10 per ton of manufacturing product, a margin sufficient to give a distinct advantage. Again, this is not to be looked upon as the result of a single influence. Only as the market reached naturally from points on the Missouri River has developed, so that it is using a quantity of steel sufficient to make production possible on a scale sufficiently large to insure economic operation, has this been made possible.

The second element in transportation is the gradual modification of freight rates which has been going on. Adjustments made through decisions of the Interstate Commerce Commission are bringing about a more definite recognition of the distance element in the fixing of rates. Earlier in this article the peculiarities of the freight rate structure have been stressed. A change in the structure has been referred to as a possibility. At no time has it been assumed, however, that a radical change would be practicable along the lines indicated. This gradual adaptation is without doubt the means through which desirable ends may be attained in course of time. While the movement in this direction has not been as extensive as many people might wish, it is undoubtedly true that the adjustments already made have had a direct effect

TABLE 2. COMPARATIVE COST OF DISTRIBUTION OF MACHINERY FROM BUFFALO, DETROIT, AND CINCINNATI[1]

DISTRIBUTION CENTERS		BUFFALO		DETROIT		CINCINNATI	
Name	Demand Factor (Capital)	Rate	Shipping Cost	Rate	Shipping Cost	Rate	Shipping Cost
New England	$ 56,714	0.740	41,980	1.030	58,410	1.145	64,960
New York City	50,532	0.695	35,120	0.970	49,020	1.085	54,800
Buffalo	20,040	0.000	00,000	0.580	11,620	0.805	16,130
Trenton	18,904	0.695	13,140	0.970	18,340	1.085	20,510
Philadelphia	41,247	0.695	28,680	0.950	39,200	1.065	43,910
Pittsburgh	26,816	0.645	17,300	0.710	19,050	0.710	19,050
Baltimore	8,308	0.695	5,785	0.940	7,810	1.055	8,765
Richmond	4,636	0.930	4,311	0.940	4,359	1.055	4,890
Charleston, W. Va.	2,262	0.830	1,878	0.740	1,674	0.620	1,403
Wilmington	6,691	1.040	6,960	1.770	11,850	1.100	7,360
Charleston, S. C.	3,745	1.130	4,231	1.795	6,720	1.125	4,214
Savannah	1,795	1.130	2,029	1.795	3,223	1.125	2,020
Atlanta	2,692	1.910	5,140	1.965	5,290	1.295	3,488
Tampa	2,063	1.475	3,043	2.405	4,964	1.735	3,580
Birmingham	4,556	1.850	8,425	1.915	8,720	1.295	5,900
Jackson, Miss.	1,541	2.090	3,220	2.120	3,268	1.470	2,265
Nashville	2,735	1.350	3,694	1.460	3,995	0.890	2,435
Memphis	1,367	1.395	1,907	1.395	1,907	1.170	1,599
Louisville	2,765	0.890	2,460	0.765	2,115	0.475	1,313
Cincinnati	9,372	0.805	7,545	0.670	6,280	0.000	0.000
Cleveland	23,429	0.605	14,175	0.565	13,240	0.660	15,460
Indianapolis	8,905	0.820	7,300	0.670	5,966	0.480	4,275
Springfield	7,575	0.990	7,500	0.780	5,910	0.725	5,490
Chicago	27,177	0.645	17,520	0.560	15,210	0.685	18,610
Detroit	23,410	0.580	13,580	0.000	0.000	0.670	15,690
Milwaukee	13,717	0.830	11,380	0.710	9,740	0.765	10,490
Minneapolis	6,904	1.385	9,565	1.255	8,685	1.330	9,185
Des Moines	4.032	1.525	6,150	1.340	5,405	1.085	4,375
Omaha	2,453	1.875	4,600	1.690	4,147	1.460	3,828
St. Louis	10,407	1.040	10,890	0.855	8,950	0.725	7,590
Kansas City	4,134	1.875	7,575	1.690	6,990	1.560	6,450
Wichita, Kans.	1,787	2.710	4,843	2.525	4,513	2.280	4,074
Oklahoma City	2,770	2.740	7,590	2.590	7,178	2.280	6,320
Little Rock	1,388	2.370	3,290	2.215	3,075	1.910	2,650
Dallas, Tex.	5,858	2.995	17,540	2.845	16,650	2.535	14,850
New Orleans	4,622	1.340	6,195	1.835	8,480	1.610	7,440
Denver, Colo.	2,438	3 500	8,530	3.315	8,080	3.185	7,760
Totals	429,587		355,251	.....	400,034	....	413,129
Index Number	......	0.827	....	0.932	....	0.962	....

Reducing the Index Numbers to the basis of unity for Buffalo, we find for Detroit 1.105, and for Cincinnati 1.135. This means for Buffalo a shipping cost with a margin of 10.5 per cent. under Detroit and 13.5 per cent. under Cincinnati for this marketing territory. These margins are close to those secured when distribution was taken on the basis of population.

It is clear that the advantage of Buffalo comes from two causes; first, its accessibility to New England, New York, Philadelphia, Pittsburgh, and Baltimore; second, its low rail-and-ocean rates to the Atlantic and Gulf ports. Had the Pacific coast cities been included the advantage of Buffalo would have been even more marked, because of the ocean ratesvia the Panama Canal.

on the building up of manufacturing enterprises at many points. Again it should be said that the factor is not to be considered as the one determining influence. In this case the modifications being made are to be looked upon chiefly as measures which have removed handicaps which would otherwise have been encountered by enterprises established for the purpose of realizing all the advantages inherent to the other localizing factors.

The increased consuming and purchasing power of the population is not to be overlooked in this connection. This is really a part of the market question. To illustrate, the growing demand for cornstarch and glucose throughout the Southwest has been the direct cause of the establishment of a large branch plant of one of the leading manufacturers of this line of goods at Kansas City, Missouri. For that company this has meant a specific westward movement in the center of gravity of its production. The growing demand of that market in the region indicated called for additional producing capacity at a point from which distribution would be effective and economical.

Finally, advances in process methods have been instrumental in the westward movement. This may be illustrated best in the iron and steel industry. As is well known by all, the blast furnace branch of the industry has been determined mainly by the sources of fuel, specifically coke. With the exception of the developments where Great Lakes traffic has made possible the westward movement of coal at very low rates, the steel industry has remained close to the centers of production of coal possessing good coking qualities. As a result of extended investigations of the coking qualities of Illinois coal, by-product plants are in successful operation in the St. Louis district. The coke produced is now being utilized in a recently established blast furnace plant in that district, and there is no doubt but that that basic industry will go forward and produce a definite effect upon the iron and steel market of the growing area tributary to St. Louis. Thus has a line of scientific research resulted in the establishment of an industry, just as in the case of the steel industry previously referred to in Kansas City, based on the recently developed metallurgical process for manufacturing steel from scrap.

Two notable examples of development in the South are at Birmingham and Chattanooga. At the former the enterprises are in iron, steel, coal products, and cement, all basic industries whose locations are based on the occurrence of raw materials under remarkably favorable conditions, combined with accessibility to the growing market of the South and Southwest. At Chattanooga the really notable development is in knit-goods based on cotton products, although metal manufactures and the by-product coke industry are also prominent. The market for knit-goods is a general one, over practically the entire country.

Quite aside from the favoring elements of raw materials, fuel, water-power from the Tennessee River, and, for some of the products, accessibility to a market of great volume and greater promise, this region of the New South has enjoyed the benefits of an especially favorable labor situation. While the workers were originally inexperienced and devoid of inherited characteristics of a factory population, they have been susceptible to training. The prevailing wage scale is low, not as a result of labor exploitation in the main, but as a natural consequence of social and economic conditions which hold living costs at a low figure. How long these conditions may hold cannot be predicted with certainty. Some of them are due solely to climate, which will continue to influence living costs in a material degree. But throughout the development period the advantage has been of pronounced significance. It has made production at low cost a possibility during a period when such an advantage is especially helpful.

It is impossible to imagine a more favorable combination of circumstances than that under which the Birmingham district has been developed. Ample deposits of iron ore, high-grade coal, limestone and shales, and water-power possibilities on two rivers, gave assurance of a notable industrial district as soon as capital should be applied and the tributary regions of the South started definitely on a progressive forward movement. Several decades ago these final conditions were realized and the result has been the creation of an industrial district of distinction.

Fortunately, the builders of the Birmingham district have seen fit to apply the teachings of modern industry. Comment has been made already on the standard of community building which makes this coal mining district a unique one. But this is not all. Throughout the entire region a corresponding spirit of enterprise and determination to build soundly for the future has been manifested. The planners of the modern Birmingham were wise enough to build adequately for the future.

Conclusion

Enough has been said to outline the basic elements which contribute to the decentralization movement. Gradually as time goes on and as industrial research continues, with the gradual adaptation of transportation cost on vital commodities to a service basis, there will come about a relocation of many of the important industries. A few have been mentioned. Many others would furnish equally enlightening illustrations. Decentralization has a bearing on the public welfare which extends into problems which have their foundations in the social structure of the nation. Artificial adjustments are not applicable to the case. The radical who would argue for immediate changes of a sweeping character transgresses the economic law. He would apply the torch and produce a conflagration where the thing needed is the carefully controlled fire of progressive enterprise. The advantages of private ownership of industry are too important to be jeopardized by ill-conceived propaganda. The influences are many, and they are so completely interrelated that the novice is an unsafe advocate. It may be taken for granted that the ideal industrial system will never be attained, but in time there will be accomplished that form of adjustment which will result in such a distribution of productive enterprises as will accord with business judgment and a correct application of fundamental economics.

Enter Order—When Will You Ship?

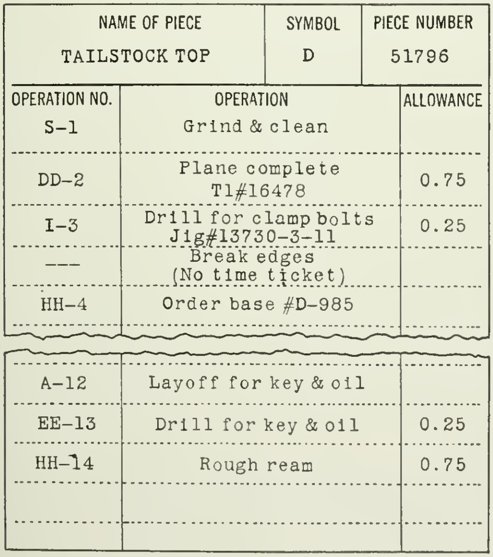
Lodge and Shipley Methods for Controlling Production

By H. S. RIGGS

Advertising Manager, The Lodge and Shipley Machine Tool Company

THE Lodge and Shipley control system is the result of many years' experience at building one product. The system has been simplified so that all unnecessary red tape is eliminated and there is no duplication of effort. It is not a one-man affair.

When an order is received for a lathe it reads in substance—"Enter order—when will you ship?" Between these two phrases there is a whole lot to do. The customer, however, is interested in getting a quick delivery. He does not want excuses; he wants his lathe. The Lodge and Shipley control system insures his getting it—*and on time!*



NAME OF PIECE	SYMBOL	PIECE NUMBER
TAILSTOCK TOP	D	51796

OPERATION NO.	OPERATION	ALLOWANCE
S-1	Grind & clean	
DD-2	Plane complete T1#16478	0.75
I-3	Drill for clamp bolts Jig#13730-3-11	0.25
———	Break edges (No time ticket)	
HH-4	Order base #D-985	
A-12	Layoff for key & oil	
EE-13	Drill for key & oil	0.25
HH-14	Rough ream	0.75

FIG. 1 ROUTING CARD SHOWING DEPARTMENTS, OPERATIONS, AND TIME ALLOWANCES

Lodge and Shipley build 13 different sizes of lathes and 10 of them are made in two styles—Selective Head and 3-Step Cone Double Back Geared Head. Eighty-nine units and subassemblies are used in assembling the final machine and attachments. In the average lathe there are about 1000 separate pieces. Consider the problem that would confront the works manager in keeping a sufficient supply of each of these parts on hand if some sort of control were not provided. Such a thing as the need of small pins could hold up the entire erection and delay delivery of the lathes for weeks.

Index Number
658.5 Production control

To simplify manufacture, the various machines are sent through the factory in lots, or runs, as they are called. The size of the run varies, of course, with the demand. These runs as a rule require from one to three weeks for erection. Each is in the process of manufacture for from two to three months depending, of course, on the urgency of that particular size lathe. The lathes are not built up until actually ordered. The finished parts are held in the stockroom until requisitions for them are sent in by the works office. In busy times, however, practically every run brought through is sold completely months before the parts are finished. At such times there is no halt in the procedure and the lathes are built right up and shipped out, any orders coming in after a lot or run of lathes is completely sold out must, of course, wait to be filled from the next run of that size to be brought through.

There are four stages into which the works office divides its job: 1. securing the material; 2. keeping a perpetual check of material on hand; 3. routing, machining, and assembling the material; 4. building the lathes. The four means of checking up on these stages to prevent unnecessary delay in shipping the finished lathes are: The Master Shortage Book which shows the material wanted but not on hand for the work—it is a loose-leaf book and provides the works manager, the purchasing department, and the shop tracers with vital information, The Perpetual Inventory Desk where records are kept of all material on hand; The Control Board which insures the work being properly laid out and ordered; The Shop "Tickler" which keeps the foremen of each department from doing work out of proper sequence.

It may be well to go over the system briefly so that a general idea can be obtained as to how the whole thing is done. The important details will follow in a later article. So that it will be as explicit as possible an order for a tailstock (a unit of the lathe) will be traced through the shop to the stockroom. Any other unit of the lathe is put through the shop in exactly the same manner.

When it is determined to build a quantity or run of tailstocks or lathes, each unit is built up into an individual bill of material or parts list, as it is called. Each run is given a number which is the means of identifying it in its travel through the shop. The engineering department is notified that a run of tailstocks is to be issued and it makes out a parts list in triplicate, and sends it to the works office. The parts list consists of a sheet or sheets on which are written the piece and drawing numbers; the name of the parts; the quantity wanted of each; together with blue-prints of all the detail parts. With the parts list in an envelope are the blue-prints of the work to be done. These are all kept together for ready reference. Each element piece has a piece number, and these piece numbers are the means of identification as to style, size, and name.

One copy of the parts list is sent to the stock control desk where reservations for all of the parts called for are made. It is then sent to the routing department for routing. (Fig. 1.) In the meantime a foundry tracer shortage has been made out and when the copy of the parts list has been returned to the works office the following are made up and issued to the shop: traveler tag, Fig. 2; master tracer shortage sheet, Fig. 3; time tickets, cost cards, Fig. 4; and stock requisitions. Complete information regarding the purpose of the three parts lists will be given later.

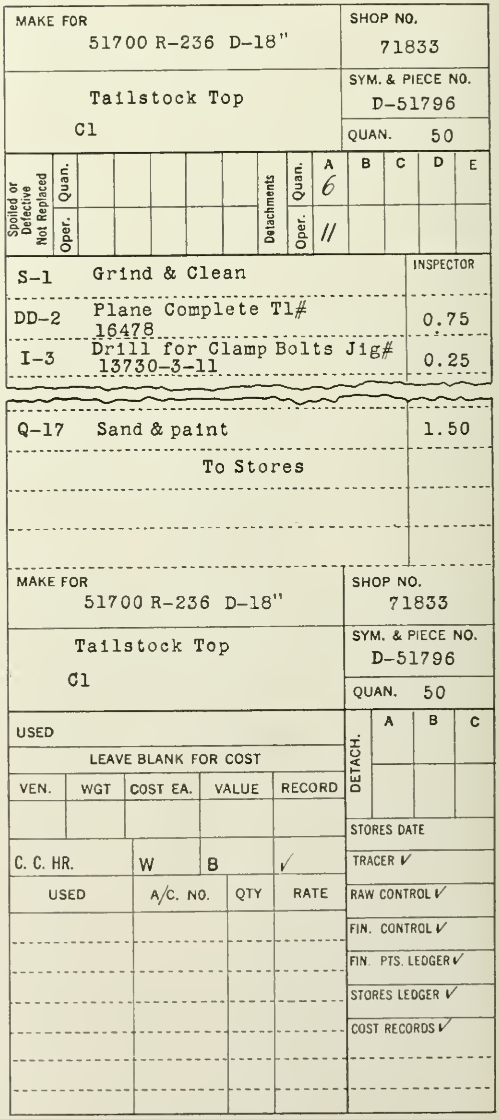
When the castings are received from the foundry at the receiving office the traveler tag, Fig. 2, is attached to one of the lot. This traveler tag accompanies each lot of parts and contains complete information about the work to be done. The lower part of this tag, the weight stub, is torn off and sent to the works office. This serves as a requisition on the raw stores and as a notice that the material has been received and has been sent to the first operation designated on the traveler tag.

The date this stub is received is posted on the tracer card, which is a copy of Fig. 2, and a metal flag is moved to the first operation. At the same time a "shop tickler" is sent to the department where the first operation is to be done. As soon as the foreman is ready to start work on the job he rings in the time card for operations he is to perform. When they are performed, he sends the time card to the works office, and this is posted on the tracer card so that the exact location of this job can be quickly determined. When the time cards are received from each department the date and mechanics number are posted under that operation on the tracer card and the flag is removed to the extreme left side of the card. A posting clerk whose duty it is to watch the successive operations, continually goes through the file of tracer cards and writes up "shop ticklers" for all cards on which the flags are on the left side. The date the "tickler" is sent out is then posted on the tracer card, and the flag moved over to the operation for which it has just been issued.

On the time card is the time actually taken to do each job. As these time cards are turned in, this information is posted to the cost card, Fig. 4, thus showing at any time the cost of each operation and the total cost as far as the work has progressed.

Just as soon as the time cards are sent in they serve as a notice that the job is ready to move to the next department. The "shop tickler" is then sent to the department where the next operation is to be done. After each operation the timekeeper puts the operators check number opposite the operations performed on the traveler tag. Inspectors punch the card opposite the job inspected, each inspector having a different punch. A job cannot be given out until it has been punched by the inspector for the previous operation.

When all of the operations called for on the master tracer are completed, and the final inspection made, the whole lot is sent to the stockroom. A receipt is issued for them by the stockkeeper and this is posted on the master tracer, Fig. 3, indicating that all pieces have been received and are in the stockroom. The



MAKE FOR 51700 R-236 D-18"	SHOP NO. 71833
Tailstock Top C1	SYM. & PIECE NO. D-51796 QUAN. 50

Spoiled or Defective Not Replaced							Detachments		A	B	C	D	E
	Quan.							Quan.	6				
	Oper.							Oper.	11				

		INSPECTOR
S-1	Grind & Clean	
DD-2	Plane Complete T1# 16478	0.75
I-3	Drill for Clamp Bolts Jig# 13730-3-11	0.25
Q-17	Sand & paint	1.50
	To Stores	

MAKE FOR 51700 R-236 D-18"	SHOP NO. 71833
Tailstock Top C1	SYM. & PIECE NO. D-51796 QUAN. 50

USED

LEAVE BLANK FOR COST

VEN.	WGT	COST EA.	VALUE	RECORD

C. C. HR.	W	B	✓
USED	A/C. NO.	QTY	RATE

DETACH.	A	B	C

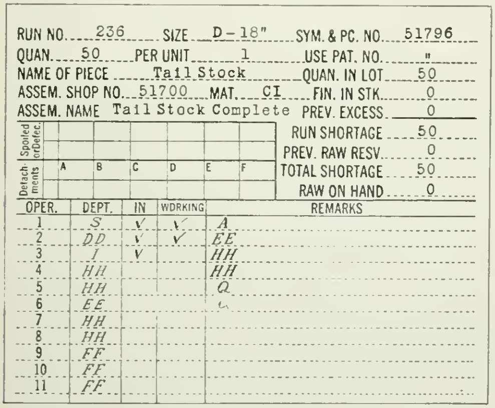
STORES DATE
TRACER ✓
RAW CONTROL ✓
FIN. CONTROL ✓
FIN. PTS. LEDGER ✓
STORES LEDGER ✓
COST RECORDS ✓

FIG. 2 TRAVELER TAG THAT ACCOMPANIES THE WORK THROUGH THE SHOP. WEIGHT TAG IS ATTACHED

master tracer is then posted to the stock control cards for future reference.

In the meantime a copy of the parts list containing all the stock requisitions for parts necessary to build the tailstocks has been sent by the works office to the stockroom. The parts called for that are in stock are delivered to the assembling department. Green shortage slips which indicate the parts that are short are also sent to the assembling department. These green shortage slips are put into an assembly shortage board at the assembly foreman's desk. From these anyone can tell immediately just what pieces are short to complete the assembly of the units. As the parts are sent to the assembly foreman the green shortage slips are removed from the board until all are gone.

A tracer is continually watching the assembly shortage board for green shortage slips. If any difference exists between his tracer shortage slips and the green shortage slips he immediately informs the stock control desk and has the difference adjusted.



RUN NO. 236 SIZE D-18" SYM. & PC. NO. 51796
QUAN. 50 PER UNIT 1 USE PAT. NO. "
NAME OF PIECE Tail Stock QUAN. IN LOT 50
ASSEM. SHOP NO. 51700 MAT. CI FIN. IN STK. 0
ASSEM. NAME Tail Stock Complete PREV. EXCESS 0
RUN SHORTAGE 50
PREV. RAW RESV. 0
TOTAL SHORTAGE 50
RAW ON HAND 0

Spoiled or Defec.						
Detachments	A	B	C	D	E	F

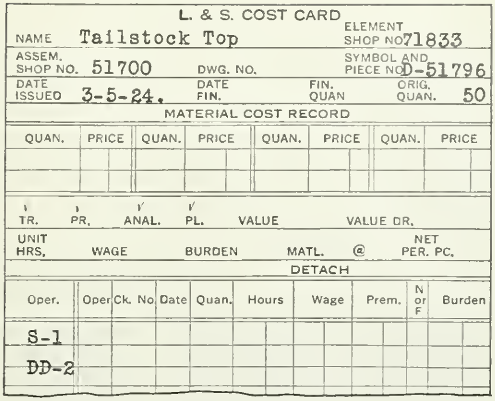
OPER.	DEPT.	IN	WORKING	REMARKS
1	S	✓	✓	A
2	DD	✓	✓	EE
3	I	✓		HH
4	HH			HH
5	HH			Q
6	EE			
7	HH			
8	HH			
9	FF			
10	FF			
11	FF			

FIG. 3 TRACER SHORTAGE SHEET USED BY WORKS MANAGER, TRACERS, AND PURCHASING DEPARTMENT TO CHECK PROGRESS OF MATERIAL THROUGH SHOP

When the tailstock is assembled it is inspected and an inspection card or assembly identification card is attached. It is then sent to the stockroom where the duplicate of the card is detached and sent to the stock control desk as a final indication that the complete assembly has been put into stock.

When there is urgent need for a few parts or units they can be brought through ahead of the lot in which they are scheduled. A detachment card which is similar to the traveler tag, is made out. The procedure in the shop is exactly the same as the regular routine only the foremen recognize a detachment as being in a hurry and give it preference. (See Fig. 5).

This gives a hasty picture of the control system used in our shop. It has been developed gradually from the time when Lodge and Shipley was a much smaller concern than it is at the present time. Each new development has been thoroughly tried and tested, to make sure of its adaptability for the particular conditions to be found in our shop, before it has been finally accepted and put into actual practice.



L. & S. COST CARD
NAME Tailstock Top ELEMENT SHOP NO 71833
ASSEM. SHOP NO. 51700 DWG. NO. SYMBOL AND PIECE NO D-51796
DATE ISSUED 3-5-24. DATE FIN. FIN. QUAN ORIG. QUAN. 50

MATERIAL COST RECORD

QUAN.	PRICE	QUAN.	PRICE	QUAN.	PRICE	QUAN.	PRICE

TR. PR. ANAL. ✓ PL. ✓ VALUE VALUE DR.
UNIT HRS. WAGE BURDEN MATL. @ NET PER. PC.

DETACH

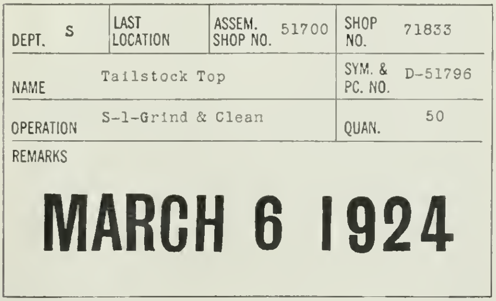
Oper.	Oper	Ck. No	Date	Quan.	Hours	Wage	Prem.	N or F	Burden
S-1									
DD-2									

FIG. 4 COST CARD SHOWING CUMULATIVE COST DATA FOR EACH JOB

Two factors have been considered of prime importance in creating control mechanisms. These are that the system should be simple and contain a minimum amount of "red tape"; and that it should be so planned that its success or failure does not rest upon the activities of one man or a small group of men. We have a system of control that is understood by all members of the organization who have anything to do with it, and is rigid enough to provide each worker with a definite method of handling each task, but still is sufficiently elastic to take care of various special orders which are received.

Because of this we are in a position to give a definite reply to the question, "Enter order—when will you ship?" and a reply that both the customer and our own organization knows can be relied upon.

In a continuation of this article that will appear in an early issue of MANAGEMENT AND ADMINISTRATION detail methods of procedure will be presented. This will be necessary in order that the reader may gain a complete understanding of the way our control system is applied to our production problems.



DEPT. S	LAST LOCATION	ASSEM. SHOP NO. 51700	SHOP NO. 71833
NAME Tailstock Top			SYM. & PC. NO. D-51796
OPERATION S-1-Grind & Clean			QUAN. 50

REMARKS

MARCH 6 1924

FIG. 5 SHOP TICKLER

A card sent to the foreman to remind him that job must be started on date specified.

Standardizing Motor Bus Bodies

Two years ago the California Body Building Company had hundreds of different sizes and shapes of patterns for use in building various styles of motor bus bodies. Nearly every order required considerable special work which made the job both slow and expensive. At that time L. McAbee took charge of the department and introduced standarization.

His first act was to have the accumulation of patterns destroyed and replaced by about 50 others that were properly designed to aid the standardization work. By making various combinations of these 50 patterns it is possible to build a number of different types of bodies. Besides reducing the number of patterns to an extent which permits them all to be hung in an orderly array on the wall (Fig. 1), the change had a very beneficial effect on the production methods used. Since nearly all patterns were used on several body styles there was a regular demand for parts made from them. This fact enables the company to produce parts in quantities to be stored in special racks (Fig. 2). Quantity production has greatly lowered the cost of bodies and because parts can now be taken from stock the speed of filling orders is increased.

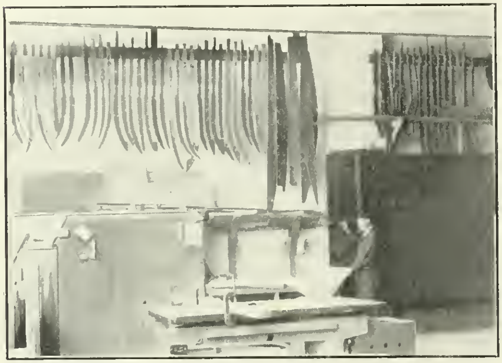


Fig. 1 Patterns Are Hung in Orderly Arrangement

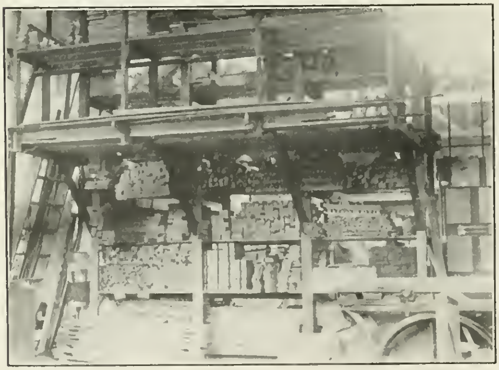


Fig. 2 Special Racks for Storing Parts

Index Number
629.113 Automobile manufacture

Drawings for special jobs are laid out to full scale on a large blackboard (Fig. 1) from which the mill foreman obtains necessary information for making any special parts required. A complete set of full-size jigs is made on all orders for five or more bodies. These jigs are adjustable to several body styles.

Bodies are erected on a portable platform which provides supports under the body sills so that doors can be hung, and also makes movement of the body about the shop an easy task for two men. The sides, floor, top, and framing are completed in the erecting department before the body is moved to the location where metal parts are attached to it. This company uses cast aluminum corners in the rear in order to increase strength and resistance to blows from collisions.

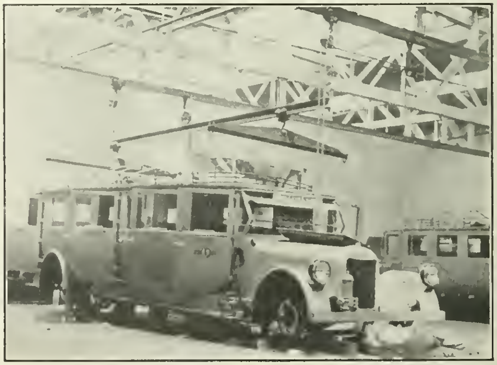


Fig. 3 Crane Used for Placing Bus Body on Chassis

A modern development is to provide space on the roof for luggage rather than in a boot at the rear of the bus. This distributes the weight more evenly, increases the appearance of the bus, and provides more carrying space for passengers. Tops of such buses are reinforced with straps of $\frac{1}{4}$ in. iron bolted to the top plates. The top of the roof is protected from excessive wear by the use of hardwood strips spaced 1 in. apart.

When the body is ready to be placed on the chassis the platform is moved under a specially designed crane (Fig. 3) by means of which the same 2 men who moved the body can quickly and easily transfer it to the chassis. This crane consists of 2 parallel I-beam tracks 90 ft. long on which run 2 chain blocks. Hanging to the blocks is an I-beam carrying 2 trolleys which support heavy trusses. To these trusses are attached the chains that hook into the sill of the bus body. The chain blocks have a 5-ft. extension on the operating shaft which enables the operators (one for each hoist) to raise and lower the body into proper position.

Industrial Unemployment Insurance

Problems Affecting Its Operation

By S. B. ACKERMAN

Assistant Professor of Insurance, New York University

UNDER our industrial system unemployment has always existed. Various plans have been instituted to alleviate this condition, one of which is commonly known as unemployment insurance. Europe has had schemes of unemployment insurance for many years. These schemes are usually state subsidized, the employer and employee contributing. In spite of these schemes, one cannot say that unemployment has been eliminated; but there is an attempt to reduce the evil by spreading the burden over society at large.

Before the World War, the demand for insurance against unemployment did not receive much attention in this country. In the United States bills have been introduced for unemployment insurance, but as yet no state legislature or congress has passed any statute covering this subject. However, this country is confronted with the demand for unemployment insurance. It is a demand arising from the organized worker and presented to the employers by union organizations. One of these unions, the Amalgamated Clothing Workers of America, has succeeded in introducing unemployment insurance as a part of its agreement with the clothing manufacturers of the Chicago market. Several other unions have similar agreements.

To those who have investigated the subject, the method followed by these unions seems anomalous. In Europe the plan of unemployment insurance is to cover employees countrywide. In the United States the plans that are being introduced do not seem to be concerned with the entire body of workers but only attempt to protect certain union employees. In England an attempt was made by manufacturers to change the general scheme covering all workers to a scheme that each industry should take care of its own unemployment problem. Manufacturers in certain trades contended that they were bearing the burden of unemployment in other lines of work. In a referendum on this subject the organized workers of England voted against the plan for unemployment insurance by industry. And yet in the United States such a plan is being advocated and introduced by workers! The probable reason for this is that the unions believe that the introduction of unemployment insurance by industry offers the easiest method to gain their purpose at the present time. The use of this method means there is no need to wait an unknown period of time for government legislation.

The contract with the Amalgamated Clothing Workers is the first contract of this character in the United States and unemployment insurance will, probably in the near future, cover the entire needle industry, because of the similar philosophy of the various needle-workers throughout this country. It is advisable, therefore, to give a complete survey of the agreement. The principal provisions are as follows:

Index Number
331.2544 Unemployment
insurance

1. The members of the union must contribute $1\frac{1}{2}$ per cent of their wages and the manufacturer must contribute a similar amount to an unemployment fund which is under the direction of a Board of Trustees.
2. No employee can receive more than an amount equal to 5 weekly benefits in a single year, but no benefits are payable unless there are funds available.
3. The benefits are only payable for involuntary unemployment resulting from lack of work. No employee is entitled to any benefit who voluntarily leaves his employment, or who is discharged for cause, or who declines to accept suitable employment. Benefits are not available to any employee while on strike or who has ceased to work in violation of the trade agreement in force.
4. If an employee has not regularly paid his contribution, his benefit is limited to one full weekly benefit for every 10 full weekly contributions in a single year.
5. In complete unemployment the employee must register with the employment exchange, and unemployment is deemed to begin on the date of registration.
6. The benefit payable is limited to 40 per cent of the average full time weekly wage of the employee, but the benefit cannot exceed $20.
7. The fund is not permitted to accumulate beyond an amount equal to double the maximum unemployment benefits which would be payable during a period of two years to all contributing employees of the manufacturer. Whenever the fund reaches that amount all further payments by the manufacturer and the employees cease except for employees who have not contributed during the period of one full year. Payments into the fund commence again when the fund is reduced to an amount less than the total maximum benefit which would be payable during a period of one year to all contributing employees.
8. Neither the manufacturer nor the union has any right, property, or interest in the fund. The fund is not subject to attachment by reason of any claim on behalf of any person against the manufacturer, the union, or an employee.

9. The principle and interest of the fund, except an amount required for current use, must be invested in the direct obligations of the United States government.

This agreement is probably not a final one. It may be said to be an experimental agreement and without doubt will ultimately be radically modified. Comparison may well be made with the Compensation Law when first introduced in this country. In a brief period of 10 years the Compensation Law has been constantly changed giving the worker greater and more adequate benefits. There is reason for the assumption that there will be a similar development of the clothing workers' agreement and it will therefore be advisable to discuss some of the problems that exist and that will eventually arise if unemployment insurance by industry is extended. The problems discussed are not necessarily intended as a criticism of the Amalgamated Worker's Agreement, but that agreement will be used as a basis for discussion.

The following problems will be considered:

1. Definition of unemployment.
2. Experience rating.
3. Period of payment of benefits.
4. Contribution by employer or employee.
5. What is industry?
6. State supervision.
7. The actuarial problem.

1. *Definition of Unemployment.*—The first problem that we have to consider is what is meant by unemployment. One definition that has been suggested is: "A workman is unemployed when he is able-bodied, willing to work, efficient at his own trade, and is unable to find employment because of lack of work." If this definition is accepted, the aged, the physically disabled, the inefficient are excluded. Such persons who are unable to find work will have to secure benefits from sources other than payment out of funds supplied by industry.

There are many other definitions of unemployment possible and it will be necessary for all future contracts to define clearly this work. The contract of the Amalgamated Clothing Workers provides that unemployment benefits shall be paid for lack of suitable work. What is suitable work? It is to be noted that this contract and other contracts are following a general tendency to pay benefits for lack of suitable work. This means that even if a worker can find some employment which he can perform in another unsuitable trade, he need not accept that employment if he does not so desire and will not lose his benefits for his refusal. It is evident that the cost of insurance will depend on whether the definition of unemployment includes lack of suitable work or inability to find work regardless of suitability. Attention should be called to the fact that if a worker will only receive benefits due to inability to find any work, he may become a competitor in a trade foreign to his own and probably will affect the living wage level.

Moreover, does suitable work mean suitable work at the employee's domicile or anywhere in the United States? To illustrate let us take the case of a young man who has no ties, whatsoever, to prevent him from going from one center to another to seek employment. The Chicago market suddenly finds itself unable to keep all of its help employed. Men become idle and there is no suitable employment to be found as a clothing worker in the home town. However, in Rochester and New York and other manufacturing centers there is an abundance of work, and insufficient hands to perform all the work necessary. Would it be proper to give this man benefits when there is sufficient work in the industry in a distant market? It is inadvisable for such a man to stay in one place and be partially supported when, in other places, he can find work at his trade.

2. *Experience rating.*—One of the provisions of the agreement makes an attempt to distinguish between types of employers. All must contribute an amount based upon the same percentage of the pay-roll, but the contributions of any employer cease when the fund contains an amount equal to twice the maximum amount that the employer would have to pay to the contributing employees for one year. There is a recognition that manufacturers have different abilities, different methods of manufacturing, and different methods of distribution. Some employers have the power to provide their employees with continuous work. Other employers are only able to operate their plant intermittently.

These facts give rise to the following question—Should not a scientific plan be devised whereby the well-organized manufacturer receives a return of part of his contribution, and the inefficient manufacturer be forced to make an additional contribution? This proposal is similar to the one used in the experience rating plan in Workmen's Compensation Insurance. Under this scientific plan the manufacturer who has a favorable loss ratio in proportion to the premium that he has paid, is allowed a premium reduction in future policy years, whereas the manufacturer whose loss ratio is unfavorable, is compelled to pay an additional charge. There is no doubt that the introduction of the experience-rating plan has made the manufacturer study methods to reduce compensation losses. A similar plan offering sufficient monetary incentive introduced in unemployment insurance would also tend to reduce periods of unemployment.

3. *Period of payment of benefits.* If the worker is unemployed for more than five weeks, he no longer can receive any assistance under this plan. It is difficult to see how an arbitrarily short period will help. In compensation insurance, the tendency is to pay the injured until he returns to work. This recognizes the right of the injured worker to be partially supported without time limitation and the cost to be charged to the specific industry in which the injured was employed. Unless a similar theory is accepted in unemployment insurance it must mean that if the employee has no funds and the union cannot aid him, he becomes an object of charity. But to prevent the worker from being an object of charity is the very aim of unemployment insurance. The period will doubtlessly be extended. If unemployment insurance is acceptable to industry then the worker should receive unemploy-

ment benefits as long as he cannot find employment.

4. *Contribution by employer and employee.* As stated in the agreement the contribution is jointly made by employer and employee. How long will joint contributions last? The worker's psychology is that he is not being paid enough and he will claim that any contribution by him lowers his standard of living. In this country there is a tendency to give the worker the benefit of social insurance as a right under the contract of employment. The Compensation Laws usually provide that it is illegal for the employee to contribute any portion of the workmen's compensation premium with the employer. The probability is that future unemployment insurance agreements will place the entire burden on the employer who, of course, will attempt to shift the cost to the consumer. The employer's problem will be to devise means to shift the incidence of unemployment insurance. Will the cost be such that it can be absorbed in the selling price of the commodity or will it be so burdensome that profits will have to be reduced and tend to drive capital out of the industry? Assuming that the clothing manufacturer bore the entire cost under the present agreement, the additional cost of manufacturing would be approximately 1 per cent. This percentage would rise, of course, if the benefits were liberalized.

5. *What is industry?*—As stated previously, the contract attempts to cover the members of a particular union. The union agreement does not include any workers unless they are members of the union. Employees working in the garment industry who do not come within the jurisdiction of the union are excluded. Unfortunately, any contract of this kind must cause ill feeling among the employees. The shutting down of a plant means that some employees will receive benefits and others will not, arraying worker against worker. In future agreements the contract should provide that all workers in the industry be included similar to the coverage of employees under our compensation law.

Furthermore, a study must be made to determine the necessary number of workers in any given industry. It is a well-known fact that certain industries are overmanned. To extend unemployment insurance by industry without the determination of the number of workers necessary means that even under the most favorable circumstances there will always be payments of benefits in the overmanned industries. This raises the question whether it is economic always to pay a certain number of employees unemployment benefits in order that there should be a constant reserve to meet unexpected contingencies.

6. *State supervision.*—As the contract under discussion did not arise due to interference by state legislation there is no provision that the state should have any supervisory power. If this is an insurance contract, especially a contract covering social insurance, should not the state have supervision over the fund and its administration? As time goes on, the state is taking a more active part in the supervision of insurance companies. Many of the operations of these companies cannot be compared in importance with the operations of an unemployment insurance board. Should the state be barred from supervising the activities arising out of the unemployment insurance agreement? Based on European experience we may expect the interference of the state. If such expectation is reasonable the right of the state in this matter should be clearly defined. The right of the state should be limited to investigation of the administration of the fund and the supervision of investments.

7. *The actuarial problem.*—In this article the words "unemployment insurance" have been used. The reason for this is that the word insurance has always been connected with contracts giving benefits against unemployment by payments out of contributed funds. The English unemployment insurance scheme which is based on a nation-wide distribution, and therefore is not as limited as an industrial fund, cannot be said to have demonstrated as yet that rates can be measured actuarially and therefore at all times provide a solvent fund. The aim of insurance is to distribute the burden and provide a fund by contributions which will always have sufficient amounts to pay any claims made upon that fund. If the English fund has not succeeded up to the present in operating on a sound insurance basis it can hardly be expected that the narrow industrial fund will succeed immediately. Even if unemployment can ultimately be measured scientifically, that time seems distant. The funds that are being created will at times find themselves with large amounts subject to the limits of the agreements, and at times with inadequate amounts, depending upon economic conditions. If the amount is inadequate, the employer will have to decide whether he desires to make further contributions to enable the worker to draw benefits due to lack of work.

The need for some form of unemployment insurance is becoming increasingly important. It has been a matter of general information for several years that the first requisite for a satisfactory job is its continuity. The larger body of workers, and that part which produces a very large proportion of our economic goods, is primarily interested in obtaining a position from which the fear of loss of income through unemployment has been eliminated. Unemployment insurance, properly conducted, will give workers affected by it a sense of security that is sure to heighten their morale and to react favorably upon their output and their viewpoint toward all industrial activity. Disregarding the humanitarian aspects of the subject, and looking at it mercenarily it promises advantages to employers outweighing any disadvantage it may possess.

It is hoped that investigation of the problems discussed will assist in the preparation of future agreements. As stated previously the agreement of the Amalgamated Clothing Workers is a pioneer agreement. The time is near for markets other than the Chicago market to consider the demand for unemployment insurance. Two new contracts are about to be made in the New York market. The operations of all these agreements should be watched with sympathy and open-mindedness, trusting that the evil of present conditions may be alleviated and that the payment of benefits will be merely incidental to the introduction of new methods to make work available to men and women in all occupations throughout the year.

Copper Bars That Bend Only One Way

IN the Research Laboratory of the General Electric Company at Schenectady there have been produced bars of copper which can be bent double with one finger but which require considerable strength to straighten again. These bars are really single crystals of pure copper and their production and examination have revealed numerous important facts concerning crystalline structure.

Heretofore knowledge of the properties of crystalline materials has been gained from the examination of quantities of small crystals of which the usual piece of metal is composed. Zinc, for instance, is known as a brittle substance since a rod of zinc will break very readily if it is bent. Yet a single small crystal of zinc can be drawn out to six times its length in one direction but is extremely brittle in the other direction. Thus the property of brittleness possessed by a rod of zinc arises from the fact that it is composed of crystals, pointing in all directions, so it has the combined properties of the crystals. If a rod could be produced in which the crystals all pointed in the same direction the rod would have properties similar to those of a single crystal.

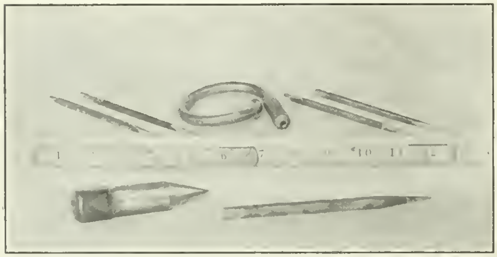


FIG. 1 COPPER BARS CONTAINING ONLY ONE CRYSTAL

Using a modification of the method devised by Dr. P. W. Bridgman of Harvard University, Dr. Wheeler P. Davey of General Electric Company has succeeded in producing a single crystal of copper $\frac{7}{8}$ in. in diam. and 6 in. long, as well as numerous smaller crystals. (See Fig. 1).

Very gradual heating and cooling of pure copper in an electric furnace was the method employed. When molten metal is cooled quickly the resultant mass is composed of very small crystals; when the cooling process is lengthened the crystals produced are larger. Following this line of thought a bar of pure copper was enclosed in a cylindrical carbon crucible, placed in an electric furnace, and the molten mass cooled so slowly that but one crystal was formed which included the entire melt. The atoms of copper were given plenty of time to arrange themselves and they formed a single large crystal rather than a multitude of small ones.

A crystal about as large as a lead pencil bends as easily as does a piece of soft wax but it cannot be straightened again any easier than an ordinary piece of copper. (See Fig. 2). When the bar is composed of a single crystal all its component atoms are arranged in columns equally spaced. When it is bent this arrangement is disturbed and it becomes a piece of ordinary copper composed of many small crystals facing in all directions.

Index Number
669.3 Copper crystals

The method by which Dr. Davey proved that he had produced a single large crystal is interesting since the crystal differs little, externally, from an ordinary piece of the metal. X-ray analysis furnished convincing proof that the rod was composed of but one copper crystal.

Usual examinations of crystalline substances consist of placing a small tube of the substance, finely powdered, in the path of a narrow beam of X-rays of known wave length. The arrangement of the atoms in each minute crystal causes the X-ray to be turned in different directions and thus produce a series of lines on a photographic film. Study of these lines then reveals the arrangement of the atoms in the crystal and their distances from each other. Copper crystals conform to the face-centered cubic system.

In examining the large crystal it was swung back and forth through an angle of 30 deg. with its edge in the path of the X-rays. The rotation of the single crystal produced the same effect as that obtained from a stationary powdered sample and a pattern was made on a stationary film. A moving film was also used mounted on the turntable with the crystal. If the specimen had not been a single crystal no lines would have been obtained on the moving film since the X-rays would have affected the entire film uniformly. The lines were obtained, however, and comparison of the two negatives showed that the axis of the crystal was parallel to the direction of cooling of the ingot.

FIG. 2 COPPER BAR, IF GIVEN A JERKING MOTION, BENDS AS EASILY AS WAX

Planning Repair Work

By L. W. CONANT

Plant Engineer, F. H. Conant's Sons, Inc.

Index Number
658.58 Maintenance and repair

TOO frequently perhaps the possibilities of scientific management are seen only in the light of their application to the major manufacturing processes of a plant. Repair and maintenance functions, and particularly the work of improvements in heating, lighting, and similar equipment, will many times offer unexpected opportunities for reducing costs. Gantt's principle that the greatest savings are to be effected through having materials invariably at hand whenever and wherever they are needed offers surprising opportunities for economies in this field.

As an example of the possibilities for improvement in work of this kind the writer can conceive of no better case than the problem of remodeling a heating or sprinkling system of piping in a plant already in operation. Methods generally employed for such work, even in well-organized establishments, are likely to be those of the ordinary plumber. Any such task necessarily involves a large supply of different varieties of pipe fittings, usually ordered especially for the job, but without any adequate record or plan as to which parts are to be used at any particular point. A natural sequence is, therefore, that from the time of receiving the material until such parts as prove to be actually needed have finally been fitted into place, the work is carried on in a shamefully hit-or-miss fashion.

Only one who has actually taken part in installation work of this kind appreciates fully the enormous amount of time and effort which can be uselessly expended in this way.

In the instance of installing vacuum hot water returns on an antiquated system of heating in an old plant, the writer had ample opportunity to observe and study the methods usually employed. When undertaking the work of replumbing a coil, for example, the plumber and his helper would attempt to carry with them from the base of supply such material as it was supposed would be required for a particular job. A dozen or more varieties of T's, L's, nipples, etc., were available, and even with the best judgment it was difficult to predetermine with any accuracy which types or sizes would be needed. As a result a number of different sizes of each kind would be thrown promiscuously into a lug box, and carried, together with the tools, to the place of operation.

Usually the actual job would be scarcely started before trouble would be encountered. Some unforeseen condition would require an unusual type of fitting, and work would be held up while the helper returned to the main source of supply to obtain one fitting. Frequently several of these would be brought to make sure of having them in the future, with the result that soon the lug-box was a conglomerate mass of fittings, including many duplicates. Through these it was necessary to paw whenever a particular fitting was required. Other objections to such a situation, which it seemed grew only worse and worse, were the time required to return superfluous parts to the supply base when the box became overloaded, and the all-too-frequent interruptions of the plumber's work.

In lieu of the above method, after a careful study had been made both of the extent and the nature of the work to be performed, the supplying of material was placed on an entirely different basis. A complete classification of all the pipe fittings required and on hand was first made, this being readily done by arranging the parts on a floor at the point of main supply, according to the type of fitting in one direction, and to size in a direction at right angles to the first. Three rather flat, wooden boxes were then provided, small enough to be easily carried, but sufficiently large to contain and make readily accessible the maximum number of each part which could possibly be required in fitting up one coil or radiator. A list of the parts was also prepared, in the order in which they lay upon the floor, and provision made for checking off any part which was used in an assembly. With this simple but complete assortment of material the plumber and helper were prepared to meet the most unlooked-for requirements, and this without hesitation or recourse to their main source of supply.

The procedure of maintaining the movable supplies was equally simple and proved quite effective. Immediately upon the completion of one job, for example, the fitting of a radiator with valves, expansion trap, and a pipe leading to the return, the completed work would be gone over and a check placed opposite the name of each part actually installed in the line. A single trip to the main source of supply with a small pan or lug-box would then suffice to replenish all of the missing parts, which could quickly be distributed to their proper places in the flat boxes by the helper upon his return. With a little care in keeping on hand the maximum number of each part which might possibly be required on any one job, and by unfailingly taking the very few moments necessary to replenish supplies between operations, highly satisfactory results were obtained, with notable savings of time, effort, and expense.

Reducing Tractor Idle Time

By CHARLES W. GEIGER

Index Number
658.281 Trucking

WHEN the material to be transported is of such nature that loading must be done piecemeal, thus requiring considerable time, the problem of keeping motive equipment in continuous operation becomes serious.

A San Francisco lumber company has solved it by using trailers and 3-wheel tractors. A trailer is supported on a specially designed jack (Fig. 1) while it is being loaded. A tractor, which has been hauling another trailer during the loading process, backs under the forward part of the load. A removable piece on the jack is knocked off allowing the load to drop on the rear of the tractor. The load is chained to the tractor and is ready to move.

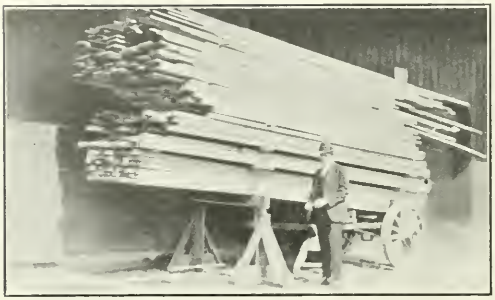


FIG. 1 TRAILER SUPPORTED ON SPECIALLY DESIGNED JACK

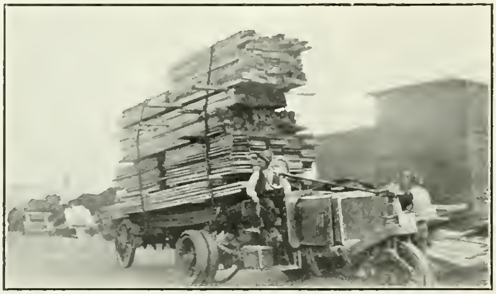


FIG. 2 LARGE LOAD OF LUMBER HAULED BY SEMI-TRAILER AND THREE-WHEEL TRACTOR

Fig. 2 gives a very good idea of the size of loads that may be carried in this way.

Use of the Routing Analysis

By J. HORACE VAN NICE

Index Number
658.512 Routing

INVESTIGATION of our blue-print department to discover the reasons for failure to meet schedules led to the conclusion that there must be unnecessary operations performed, for, while the general planning department routine seemed to be followed the finished prints came through the process entirely too slowly. A routing analysis was decided upon to uncover the trouble.

A detailed record of even the most trivial operations brought out the desired information. For example, when the long roll of printed paper came from the machine it was sent to the trimming gang following the official layout of the job. But the routing analysis betrayed the fact that the trimming was subdivided into 7 separate operations, and that these were separated into 3 different periods, by one inspection and one numbering operation. The gang boss had made this finer division thinking to make the individual operations nearer fool-proof. It took very little time-study to convince him of his error.

Some other facts concerning the methods then used that were brought out by the routing analysis were:

1. That the official layout was constantly disregarded by gang bosses who gave preferential or special service at the cost of the regularly scheduled jobs.
2. That the failure to meet schedules had been "remedied" by adding to the force, with the result that many operations had been literally divided until the time required was several times the original allowance, while the surplus help merely caused inaccurate work.
3. That division of responsibility had led to duplication of gangs supposedly doing the same work, with the result that oftentimes a double order was printed, and the extra prints destroyed by the shipping group.
4. That orders going through the regular process were robbed to complete special orders.
5. That groups were organized for particular operations and did nothing unless their particular class of work was necessary on the order then in process.

In other words, the routing analysis made by following the job in detail brought out all the weaknesses of the system. Since "Knowledge is Power," the analysis furnished the planning department with all the necessary facts with which to combat the evils.

Sheet Steel Stacking Equipment

By A. L. GREENE

Buffalo Forge Company

Index Number
658.281 Iudustrial trucks

FOR the purpose of small unit transportation in the industrial plant, the electric truck has efficiently filled the needs. For lifting purposes, the hand and electric crane is familiar to all. The limitation of the former lies in the fact that it is a one-level unit, or at best capable of only small elevations; the drawback to the latter, particularly in the case of handling a large number of small articles over considerable areas of floor space, is the element of time and labor costs.

Undoubtedly each factory has its own individual

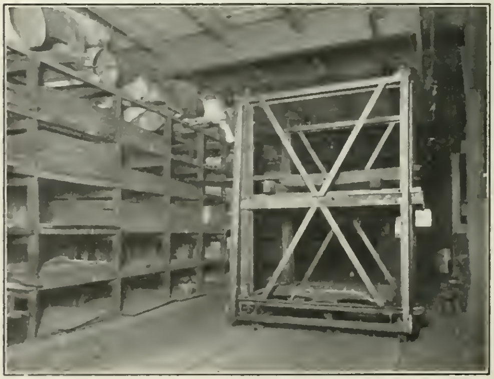


FIG. 1 RAILWAY ELEVATOR

transportation problems to solve, depending in each case on a multitude of varied factors, such as character of product, weight, placement, height, etc. In solving some of these problems, considerable skill and ingenuity frequently are exercised in designing an apparatus to fill the particular need.

A case in point concerns the difficulties experienced in stocking sheet steel plates at the plant of the Buffalo Forge Company. Specially constructed racks were built extending the entire width of the room and from the floor line to the ceiling, some 14 ft. in height. The difficulty here was to find an efficient way to pile the heavy plates in the upper tier of racks. For some time a force of laborers was employed to stack these by hand. To unload an average car of steel (35 to 40 tons) it required 5 men working steadily for 4 days. Aside from the excessive labor costs entailed, this method had other disadvantages. It was difficult to keep a labor force employed at this kind of work, while considerable loss of time was also experienced in taking the sheet steel down from the racks again when needed. The space required by the metal while waiting to be stacked required valuable floor area as well.

It was finally decided to install an elevator railway. Because of the heavy duty for which this apparatus was to be used, the company officials decided to build a unit to suit their particular needs. The result is shown in the accompanying illustration.

This unit has an elevating platform approximately 96 x 93 in. The height is 12 ft. It is of all steel construction and has two trucks of 7 ft. gage, running on rails sunk flush with the floor. Floor clearance is 9 in. For motive power a constant speed, 3 hp. electric motor operates the truck forward or backward on the track, and by means of a gear shift of special design this same motor is made to operate the platform—that is, to raise or lower it as desired. The truck and platform, however, cannot be operated at the same time. Electric current is supplied by means of an overhead trolley connection.

The factor in design which differentiates this from the usual elevator railway is the employment of four screw hoists for operating the platform. The usual arrangement is to use but two hoists. The screw hoists used here are each 2 in. in diameter and 12 ft. in length, one being placed at each corner of the truck. Each screw is supported at the bottom and top in babbitted bearings; the lower bearing, however, acts merely in the capacity of a stabilizer, while the upper bearing acts as the screw support. In this manner, the four screw hoists exert a pull, rather than a thrust, when raising the platform, and thereby buckling is prevented. The driving power for each screw is applied at the lower bearing support. A lifting capacity of approximately 10 tons is possible with this elevator railway.

The time, labor, and cost-saving effected by this apparatus in the plant of the Buffalo Forge Company is illustrated by the following: In place of 5 men needing 4 days to unload a car of steel, it now takes 2 men but half a day to unload this same amount. This represents a saving in labor costs of $80 for one car alone. This modified railway again proves a great labor-saving device in removing the steel from the racks. The illustration here shows the clear area of floor space afforded by having the sheet metal properly stacked in the racks at all times. Each rack is numbered with the gage metal it contains, as well as the dimensions of the sheets. With this rail truck handy it is not necessary to maintain a special force of laborers stacking these sheet steel plates in the racks; instead any one man can operate the truck as his needs require.

Home-Owning Plan

Index Number
658.3833 Employee housing plan

TO assist its employees who wish to own their own homes, the General Electric Company has instituted a Home-Owning Plan. Nearly everyone has a desire at one time or another to own a home. Many, however, even though they have some money saved and sufficient earning capacity to make the future payments, hesitate when they realize the legal procedure necessary and, especially, the difficulty of securing a second mortgage.

The General Electric Company has made it possible for an employee of established service and standing to secure a second mortgage, providing he is able to invest at least 10 per cent of the value of the property and has secured a first mortgage. The company will, on approval of the Works Housing Committee, assist him to finance a second mortgage through a local bank.

So that the financial obligations may be met with the least trouble, arrangements can be made with the company whereby weekly deductions are made from the employee's pay envelope, the deductions to be determined by the amount of the second mortgage. This method relieves the employee of all worry regarding the mortgage, as the company assumes the responsibility of having money at the bank to meet interest payments.

Second mortgage payments are adjusted each quarter. Total payments during the quarter are applied, first in paying interest due, and the remainder in reducing the principal. This plan, similar to that of Building and Loan Associations, liquidates the obligation in a short time, which is, of course, desirable. Second mortgages under the General Electric plan must be paid within 8 years, and weekly deductions are based on this period. For example, a $2000 second mortgage may be paid off by weekly wage deductions of $6. At the end of the first quarter, $78 would be accumulated, of which $30 would be used for interest payments and $48 applied against the principal. At the end of the eighth year, this $78 would be divided, $1.85 interest and $76.15 principal, and the next quarter would wipe out the debt.

This plan is intended to aid employees in obtaining homes for their own use. It will not be used to help them purchase houses for investment. Only one- or two-family houses can be obtained and the employee, in order to be eligible for assistance, must own no other houses. Wide latitude, in keeping with sound judgment, is allowed the employee in selecting the location of his home, and he may either buy or build.

THE EDITORS' PAGE

What Does Your Equipment Save?

In many of their contacts with manufacturing plants, the editors of Management and Administration have had occasion to ask: What does your equipment save? There seems to be in the answers a strong conviction that mechanical methods for handling materials, improved machinery for manufacturing, newer devices for power generation, greater facilities connected with the plant buildings, and all other betterments, have more than justified their costs. But as for calculating operating expenses, unit costs, and the actual savings brought about, this has rarely been done. Preliminary judgment, and the statement or guarantee of the maker of such equipment finally closed the contract, and there has been no follow-up to see what really was accomplished.

Here is a serious matter. In the first place, it is poor management not to know such facts. The equipment may be losing money for the concern, although this is not often the case.

The real truth, however, is that in most cases the maker of the new equipment never got full credit for what was actually accomplished through his apparatus in the way of savings. Probably many managers who win laurel crowns for successful plant operation, owe a lot of this credit to the manufacturers who have sold them equipment, neither party to the transaction realizing that the buyer was going to fall into a veritable gold mine of savings.

This is the other side of the story. How few manufacturers take the trouble to find out what savings customers actually make through the use of new equipment which they have installed! What red-hot selling arguments they pass up by missing these opportunities! The information is not hard to get. Through their own organizations, or some trained outside agency, this data can be correctly and fully compiled. The compilation is, in most cases, just as gratifying to the customer as it is to the maker of the equipment. Nothing compares with such definite proof of service, in building up friendship and good-will between buyer and seller. Moreover, it is up to the maker of the equipment to see that the customer knows how to run it with the highest economy, and how to get the very most out of it.

Managers, therefore, lose chances of demonstrating executive ability to their stockholders when they buy and operate equipment without going to the trouble of thoroughly analyzing the results. If a mistake has been made in the purchase, it is better to know it and correct it at once. If the new equipment does even better than anticipated, surely no manager wants to hide the fact that in its selection he has demonstrated that he is a good manager. As for the maker of the apparatus, nothing succeeds like success. Nothing will pull in orders and build up profits and prestige like the convincing and undisputable evidence of past achievements that have gone way beyond original guarantees in saving money to the purchaser.

Management Week

Management Week, October 20 to 25, 1924, was observed in 47 centers. Reports of many of these meetings, sent in at the request of Management and Administration by the chairmen or secretaries of local committees, show live interest in the topic, "Better Management Through Budgeting."

In 35 cities from which we have complete reports, the nature of observances was as follows:

Luncheon or dinner meetings..	67
Professional meetings.........	41
Civic club meetings...........	13
Radio talks..................	19
Number of talks delivered......	162

The luncheon meetings proved the most popular from point of numbers held. It is difficult to draw a distinction between professional and civic club meetings, because members of each of these classes of associations intermingled at both. Bankers, business men, managers, accountants, engineers, and public officials all had a share in making the week a success.

The committees, both central and local, representing the five participating national societies and many civic clubs, deserve the heartiest congratulations, not only for picking out the topic and planning the observance, but also for getting the idea across in such splendid shape. In scarcely any instance was the topic side-stepped for some other theme.

Business Ethics

Caveat emptor? No, it is no longer considered good form in the best business circles to put the burden of proof on the buyer. The days when business transactions were conducted under the same rules of conduct as those prevailing in the profession of which David Harum was such an able exponent, have gone, never to come back. Business is no longer trying to get as much return as possible for as little service as possible. Instead, the exact reverse of this is the prevailing spirit among business men of today.

There are many reasons for this change. Possibly the most potent one was succinctly expressed by B. A. Frankin at the 1924 National Convention of the Society of Industrial Engineers when he said, ". . . there is more profit in working for service than there is in working for profit." Profit is the ultimate reason for the existence of every business enterprise, and no mode of industrial procedure will long endure that does not contribute in some way to the financial success of the enterprise. It is particularly gratifying to know that modern business has become convinced that not only does working for the interests of the public give a profound feeling of satisfaction, but it also is an investment that pays big dividends.

An oft-quoted example of this is the career of Henry Ford. In numerous statements he has given the purpose of his company as being, primarily, service—to give the public the greatest value possible for the least outlay of money. Obviously, there have been many other important factors contributing to his phenomenal success, but in the absence of contradictory information, one is inclined to give due credit to all the mechanisms he uses, and rendering service is an important one.

A manifestation of this application of a modernized Golden Rule to business transactions is seen in the numbers of codes of business conduct that have been prepared and adopted by all sorts of business organizations throughout the country. A short while ago we had the privilege of seeing a collection of over 200 such codes covering practically every branch of business activity in the country. The Chamber of Commerce of the United States has compiled ethical codes of about 95 trade associations and more are being added constantly.

Although some of these codes are devoted to trade practices and customs to the exclusion of any rules of conduct, a large majority of them set forth ethical principles upon which are based all their trade regulations. At their last annual meeting the National Chamber of Commerce adopted 15 principles of business conduct which are representative of those now used to govern business dealings throughout the country. And, to our mind, in their first principle is expressed the epitome of the other 14 and of all similar codes. This first principle of conduct is: *The foundation of business is confidence, which springs from integrity, fair dealing, efficient service, and mutual benefit.*

Any business which agrees with this principle and adopts it as a guide for all transactions will be well equipped to render service of the highest type.

Administration

COL. GEORGE D. BABCOCK presented a paper in Chicago during Management Week on "The Problem of Administration." As an opening to his discussion he explained industrial administration and the activities of the industrial administrator. This section of the paper, instructive as one interpretation of a part of industrial operation, follows:

> Our administrator must be at the head or apex of the affairs which we shall discuss, be final authority in matters pertaining to all activities and must be a co-ordinator and then a commander of the organization.
>
> His activities may be carried on by personal contact with the members of his staff, or all of his major personnel, by conference, by direct instruction, written or verbal; or by standardized relationships, policies, and practices, so that repetition or routine may be carried out efficiently and without conflict.
>
> Where divisions of a business or industry are not closely related, the administrator is chiefly active in policies, but in an industrial enterprise where all divisions are interested in one product, co-ordination must be effected and commands given. If a normal administrator delegates his authority to one or more of his personnel, they become the administrators in his stead. For the successful conduct of an enterprise with a complex product, someone, somewhere, with or without authority, must have the ability to co-ordinate and practice administration.
>
> Merchandising a variety of articles not closely related in kind or use, manufacturing a variety of parts which are not from a common material but which are distributed unassembled, are not complex products in the sense of administration, but the merchandising of complex installations, whether domestic or engineering, or the manufacture of complex assemblies as finished products, require a co-ordinating administrator.
>
> The administration problem of manufacturing a complex product assembled from a variety of parts, produced from a variety of raw material contains nearly all of the elements that come to a business or industrial administrator, since it involves:
>
> Organization,
> Finance and Law,
> Engineering,
> Purchasing,
> Material Control,
> Manufacturing,
> Sales and Distribution.

MANAGEMENT AND ADMINISTRATION will be glad to receive comments and points of view on Colonel Babcock's interpretation of this major industrial activity and responsibility.

A Pioneer in Cost Accounting

SO fully developed is cost accounting as a science and profession that its comparative newness is often lost sight of. Only when an event occurs which brings some part of its beginning home to us do we pause and measure the development in terms of time. Such an event is the death of J. Lee Nicholson, accurately characterized as a pioneer cost accountant and sometimes referred to as the Father of Cost Accounting.

After a few years spent in industry and accounting Nicholson founded his own accounting firm, in 1889. From that time on he became an increasing factor in the development of accounting practice. To him belongs the great credit of pioneering in the study of factory costs and the development of cost accounting as an off-shoot of general accounting. In fact his book "Factory Organization and Costs" was the first book dealing with cost accounting by an American accountant. It was published as recently as 1909.

Nicholson also was the founder of the National Association of Cost Accountants. After the conclusion of his war service he issued a call for an organization meeting in the fall of 1919. The Association was founded and he became its first president.

Each of these developments is an achievement in itself and a tribute to the courage, energy, and tirelessness of one who possessed the spirit of the pioneer. American industry owes much to him, to his work, and to the inspiration that he shed upon those who were associated with him.

INDUSTRIAL EQUIPMENT

NEWS FOR THE MANAGEMENT

This department is conducted to give our readers essential facts regarding items of industrial equipment recently placed on the market, that may be used to increase production or lower costs. Each item is indexed according to the Dewey Decimal System so that it can be accurately filed for future reference. The editors will be glad to furnish additional information about any item. All information given is obtained from reputable manufacturers, and MANAGEMENT AND ADMINISTRATION accepts it as reliable.

Pyrometers

Index Number
662.612 Pyrometers

REPUBLIC FLOW METERS COMPANY has developed three new pyrometers. One is an indicating, wall type equipped with a moisture-proof 12-point rotary, selective, double pole switch. The scale is long, resulting in open graduations. It is constructed in a manner similar to other Republic pyrometers with extensive use of die castings and Bakelite mouldings, and all parts interchangeable. Four thermocouple elements are standard and are equipped with moisture-proof, enclosed, thermocouple heads.

A recording pyrometer is another new product. This has been designed so that no power passes through the timing escapement. Two independent charts are used whereby scale ranges from 32-800 deg. F. to 32-3000 deg. F. can be obtained. Actual scale length is 5¼ in., resulting in easily read, open graduations. Record is made on the chart through a carbon ribbon which, after each imprint, is removed from the range of vision so that the chart can always be read.

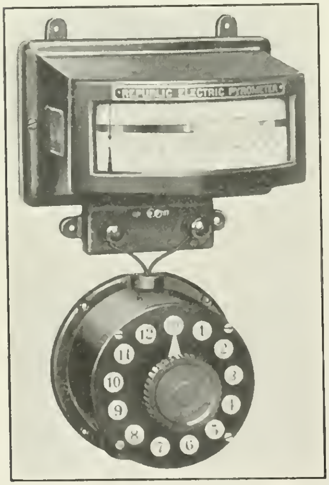


FIG. 1 WALL TYPE INDICATING PYROMETER

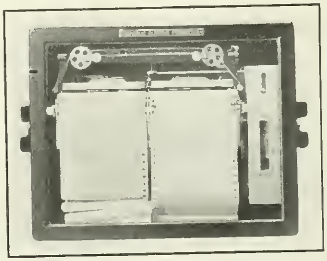


FIG. 2 RECORDING PYROMETER

Republic Flow Meters Company is also manufacturing a portable pyrometer, for use in checking. It has an "on and off" damping switch, easily readable scale, accessible binding posts, and no cover. Like all Republic electric systems, this is automatically compensated by a Briguet spiral attached to the control spring.

Heavy Duty Trailer

Index Number
658.281 Industrial trucks

TO save time in transporting steam shovels and other heavy duty equipment the Reliance Trailer and Truck Company, Incorporated, has developed a heavy duty trailer capable of hauling a 30-ton load.

The trailer has six wheels: two in front and four in the rear. The front wheels have 10-in. dual tires while the rear ones are equipped with 7-in. duals. This gives a gross of 96 in. of rubber capable of sustaining 67,200 lb. at 700 lb. per in. channel base of tire, the requirements of most state laws. The wheels on the rear are mounted in a line across the trailer and are in pairs, on two independent rear axles. Each set of wheels can revolve in a vertical plane; thus full road contact across the face of the tires is maintained on all wheels over all road or grade conditions.

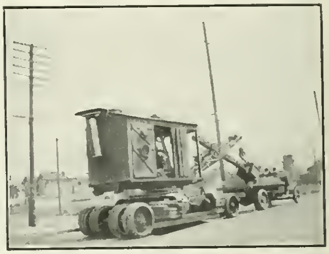


FIG. 1 HEAVY DUTY TRAILER

The low loading edge allows shovels and other tractor equipment to be run up on the trailer under their own power. The trailer is equipped with Timken bearings so that the minimum of tractive effort is required to move it. All four rear wheels are equipped with heavy duty external contracting brakes.

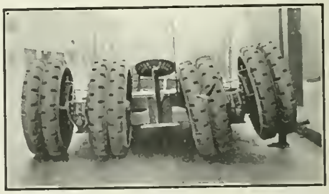


FIG. 2 HEAVY DUTY TRAILER SHOWING INDEPENDENT ACTION OF REAR WHEELS

Unit Elevator

Index Number
621.867 Electric elevators

A NEW type of electric elevator designed particularly for use in places where an elevator with self-supporting structure would be desirable is being manufactured by New Jersey Foundry and Machine Company. It is so designed that it can be erected quickly by ordinary mechanics and operated by unskilled laborers.

It is a regular freight elevator with a self-supporting structure containing built-in units that require no technical knowledge to assemble in the field. It is claimed that with extra help on some of the heavier parts, two men should erect a machine complete in two days. Adjustments are few and are all made at the factory. There is no field wiring. Field electrical connections can be made in only one way and by a laborer without the use of a tool.

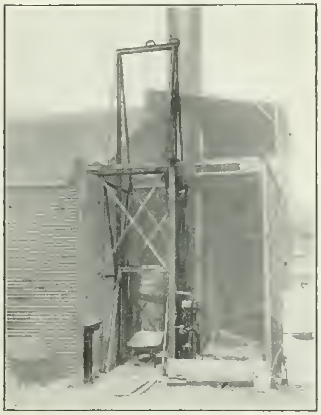


FIG. 1 UNIT ELEVATOR

Drive is a worm and gear running in oil. Motor and controller are reversing hoist type. Up and down travel limits and brake are electric so that control of platform travel and safety stops are obtained through fixed wiring. Controller is rope operated from platform or either level.

Asphalt Pump

Index Number
621.64 Pumps

THE BARBER ASPHALT COMPANY is marketing an asphalt pump in the design of which attention has been given to simplicity, minimum number of wearing parts, and ease of operation. All asphalt passages are straight and steam jackets cover all moving parts and packing so that the pump can be stopped or started at will without clearing out. It is furnished in three standard sizes with rated capacities of 50 gal. and 200 gal. per min.

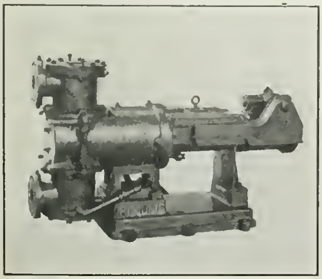


FIG. 1 ASPHALT PUMP

Automatic Compensator

Index Number
621.3193 Starting compensators

AN Automatic High Voltage Compensator has been placed on the market by the Electric Controller and Manufacturing Company. It is built for voltages of 2500 and below. It is push-button operated and entirely automatic. With the exception of the overload panel, which is mounted on the top of the tank, the compensator is entirely submerged in oil and the tank is designed to make it dust-proof, weather-proof, vapor-proof and fire-proof. It can be installed either indoors or outdoors.

A push-button is operated by an independent low-voltage circuit which is taken from an independent transformer so that there is no danger of the operator ever coming into contact with the high-voltage circuit. Having the starting transformers and the operating mechanism entirely submerged in oil and automatically operated removes all possibility of explosions or high voltage flashes.

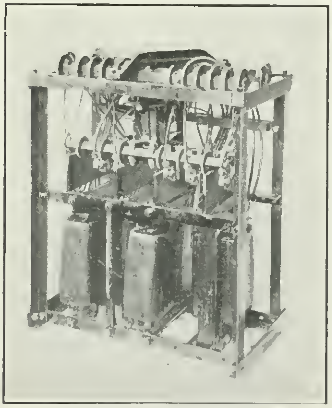


FIG. 1 AUTOMATIC HIGH VOLTAGE COMPENSATOR

This compensator is designed to apply continuous torque to the motor from the time the push-button is pressed until the motor has been brought up to speed. Operating the start switch causes the motor to be started under reduced voltage obtained from the transformers in the compensator, and after the motor has reached the proper and safe speed it is automatically thrown across the line.

Electric Light Cleaner

Index Number
658.24 Lighting equipment

PROPER plant lighting is an important item in promoting working efficiency and during the winter months it is of increased importance. Clean light bulbs and reflectors are an important factor in correct lighting. The Electric Light and Reflector Cleaner Company is marketing a device by means of which lights and reflectors can be cleaned directly from the floor without the bother and hazards of stepladders, with no fear of being knocked down or caught by moving belts, shafts, and pulleys, and without the use of rags, soap, and water.

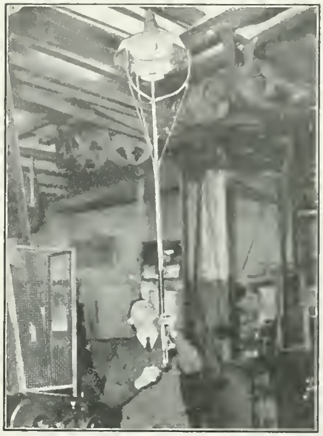


FIG. 1 ELECTRIC LIGHT CLEANER

The device consists of revolving brushes mounted on a shaft which is enclosed in a sleeve to which are attached three arms. From the handle the arms are spread to grasp the reflector, thus relieving the operator of its weight. Turning the crank revolves the brushes, which can be guided to clean the entire reflector and the bulb. It is being made in sizes to clean all styles of reflectors and in lengths to clean lamps from 7 ft. to 25 ft. above the floor.

New Writing Machine

Index Number
651.264 Writing machines

ONE of the latest mechanical units in the record writing field is a product recently placed upon the market by the Elliott-Fisher Company which is known as the Double Barrel Automatic Feed Machine. The machine may be loaded with from 500 to 1000 sets of continuous length forms interleaved with various thicknesses of carbon, and these forms feed through the machine over a flat writing surface, much as do the cartridge belts on a machine gun. Once the machine is "loaded" the operator devotes her entire time to actual writing, merely pausing to cut off each set, which brings the next set into writing position.

The Double Barrel model can handle different sets of continuous length forms set up side by side, so that one clerk, in the course of each day's work, can change from one set of forms to the other without loss of time. Where the work involves the writing of different sets of multi-copy records, the new model gives rapid production at decreased expense, since only one writing head is used and but one operator needed. For example, the same clerk may write both Order Sets and Invoice Sets; Invoices and Credit Memos; Bills of Lading and Express or Parcel Post Receipts; Outbound and Inbound Freight Bills; Prepaid and Collect Freight Bills; City and Country Collection Letters, etc. It will handle cut forms as well as all styles of continuous length forms, and where computation is desired, a different writing head may be substituted which not only performs all the functions of a writing head, but also automatically adds and subtracts.

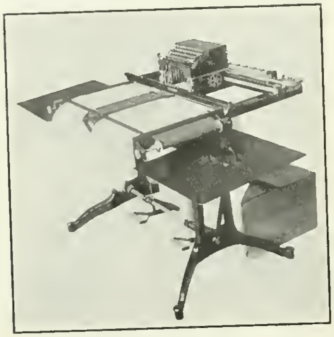


Fig. 1 Double Barrel Automatic Feed Machine

Controlled Heat Glue Pot

Index Number 651.4662 Glue pots

Changing climatic conditions and different grades of glue tend to vary the temperature to which glue must be heated, and this, with the requirements of different temperatures to produce certain results, has made heat control of the glue pot a necessity, if all conditions are to be met successfully.

To meet the demand for a glue pot of this kind, the Westinghouse Electric and Manufacturing Company has designed a pot equipped with a rheostatic control. This new device gives a wide range of heat control and also permits almost unlimited variation in the wattage input and in temperature. The unit is a portable device as the rheostat can be laid on a bench or shelf or hung on a wall while a cord between the rheostat and the glue pot permits the glue pot being moved over a large radius. The convenience of having the glue pot at the best location saves many steps to a central glue pot.

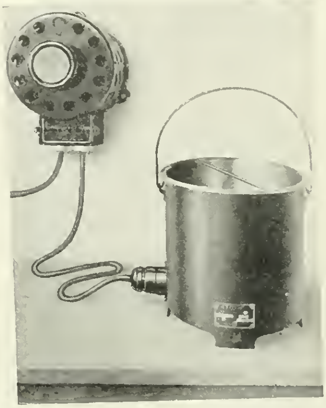


Fig. 1 Controlled Heat Glue Pot

The dry type glue pot is used with this new unit because of its many advantages over the wet type. The glue pot casing and bottom plate are made of heavy sheet steel and the glue vessel of heavy spun copper. The glue vessel may be removed and easily cleaned.

Heat Exchanger

Index Number 662.9 Industrial heating devices

For the interchange of heat between crude oil feed stock and still bottoms, cold water and hot oil or other liquids, for heating feed stock with hot still vapors, and similar services, The Griscom-Russell Company has developed a new heat exchanger.

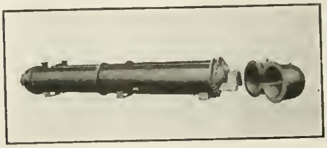


Fig. 1 Heat Exchanger

Two short exchangers have been connected by a flexible bend and shell cover to give a compact, easily installed unit about half the length of a single unit designed for equivalent duty. The cooling liquid and the liquid to be heated flow in opposite directions. Two styles of baffles are used to guide the liquid around the tubes, the selection depending upon the allowable pressure loss in the shell. All oil connections are at the same end to simplify piping, and floating heads and head covers eliminate strain on tube heads and prevent danger of cracked tube plates.

Amperehour Meter

Index Number 621.3174 Amperemeters

A new amperehour meter, designated as Type N, is being manufactured by Sangamo Electric Company. This meter measures the product of current and time without regard to voltage. It is designed, particularly, for use on every type of storage battery installation not only to indicate the state of charge of the battery but to terminate the charge automatically when battery is full.

In designing the meter, attention has been given to simplicity, accuracy, and durability. It consists, essentially, of a single copper disk rotating in a mercury chamber which is located between the pole tips of two permanent magnets. The shaft and a small counterweight are the only exposed moving parts. A moisture-proof steel case protects the meter proper, which has no delicate parts to be shaken loose or damaged by vibration or shock.

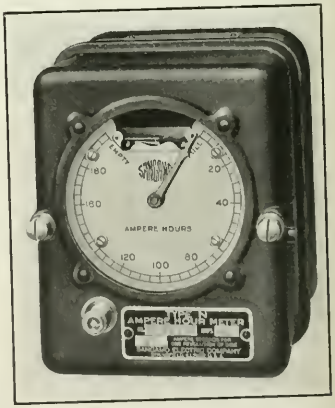


Fig. 1 Amperehour Meter

The simple meters without resistors are built in capacities varying from

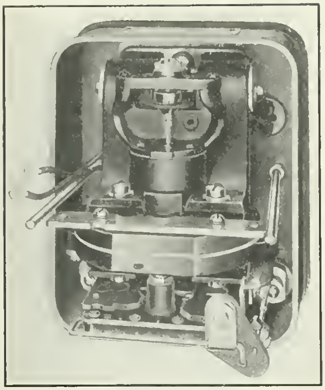


FIG. 2 METER WITH COVER OFF

2.5 amp. upwards. Battery control meters are furnished in capacities from 10 amp. up.

Lift Truck for Storage Batteries

Index Number 658.281 Industrial trucks

ONE of the newest developments in the lift truck and skid system is a lift truck for removing storage batteries from electric vehicle trucks. This lift truck is manufactured by the Sturdi-Truck Manufacturing Company.

The process is simple. The lift truck is pushed beneath the storage battery cradle and is elevated until the cradle is lifted clear of its supports. The cradle with its load of batteries is then conveniently moved to the charging station, where the truck lowers the batteries on supports. The truck is withdrawn and ready for the next job.

The batteries are not handled at any time during the process of removing, changing, and replacing. They are replaced by reversing the removal process. Until the introduction of this system the batteries had to be handled separately four different times: they were removed from the cradle to a platform truck, lifted from the platform truck to the charging platform, handled again from the charging station to the platform truck, and finally handled from the platform truck back to the cradle again. In the large garages operating electric trucks one man takes care of all recharging—doing the work formerly requiring three or four men.

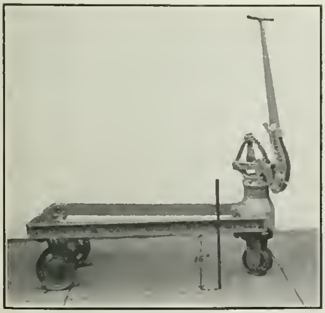


FIG. 1 LIFT TRUCK FOR STORAGE BATTERIES

Precision Measuring Instrument

Index Number 621.7163 Precision measuring

THE "Minimeter," being marketed by Norma-Hoffman Bearings Corporation, is an instrument for making rapid measurements, correct within 1/10,000 of an inch, of such products as rollers, balls, gears, rings, wrist-pins, push rods, valves, discs, washers, keys, pins, bushings, and similar parts small enough to be readily handled in the ordinary Minimeter mounting.

It consists of a single lever which has a pointer and which has two unequal arms resting upon two knife-edges. The arc described by the end of the pointer in its movement is determined by the distance between the two knife-edges. The instrument is set by means of standards or gage blocks, the pointer being brought to zero on the scale by adjusting the movable base. Depressing the lever shown in the illustration raises the contact point for inserting parts to be measured. When the contact point is lowered the pointer registers on the scale in 1/10,000 in. the deviation, either plus or minus, from standard.

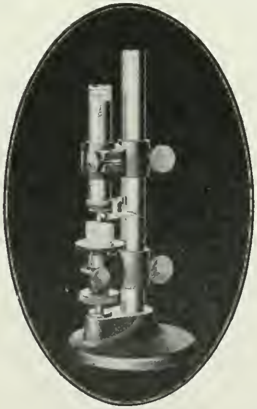


FIG. 1 PRECISION MEASURING INSTRUMENT

Bookkeeping and Figuring Machines

Index Number 651.264 Calculating machines

SUNDSTRAND ADDING MACHINE COMPANY is marketing two devices that will be of interest to business men. One is a bookkeeping machine which provides for the writing of such records as accounts receivable and payable, general ledger sheets, and monthly and bank statements, and which offers as well the general usefulness of an adding machine with direct subtraction feature.

The machine is adjustable to any variety of forms, the carriage automatically cross-tabulates from left to right, stopping as determined by adjustable stops to receive imprint and control machine functions (non-addition, addition, subtraction, and paper feed). When the stop plate is removed the machine becomes a direct subtraction-adding-listing-calculating machine. The usual paper roll is carried at the rear of the carriage. It can be furnished in either electric- or hand-operated models. Operating bar of electric models is placed to the right of the keyboard.

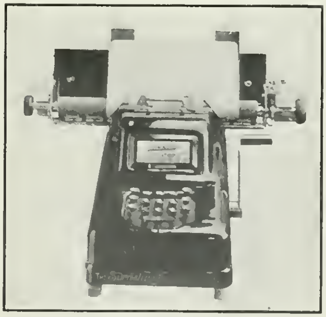


FIG. 1 BOOKKEEPING AND FIGURING MACHINE

The other new product of Sundstrand is a figuring machine which combines adding, listing, automatic shift multiplication, and direct subtraction. This is a small portable machine of convenient desk size equipped with Sundstrand Standard 10-key keyboard. Automatic column selection, one-hand control, automatic subtotals, visible writing, and forced printing of totals are other features of this machine common to other models. This machine has 7 columns capacity, up to one hundred thousand dollars.

"Lo-Hed" Hoist

Index Number 658.2812 Power hoists

THE AMERICAN ENGINEERING COMPANY is manufacturing a monorail electric hoist which requires very small head room for operation. For a 1-ton hoist this is 10 in. from the bottom of the I-beam and 14 in. for 3-ton hoists. This factor permits the Lo-Hed Hoist to be used where the height of ceilings, size of pieces to be handled, or obstructions to be cleared have, heretofore, prohibited the use of mechanical equipment. Because of the greater height to which materials can be stacked with the Lo-Hed, its use adds to the capacity of warehouses and other storage places.

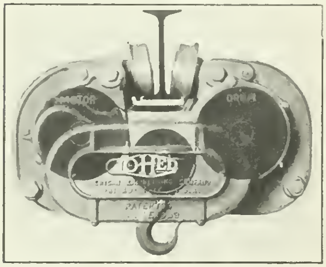


FIG. 1 "LO-HED" HOIST

Automatic holding and lowering brakes and upper limit device safeguard the operation of the hoist. It has a mechanical efficiency of 80 per cent and, at full load, a safety factor of, at least 5 per cent. Positive automatic lubrication is provided.

Hoists are made in capacities for 1,000 lb. to 12,000 lb. for either alternating or direct current and for floor or cab control.

Addressing Machine and Graphotype

Index Number 651.26 Addressing machine

ADDRESSOGRAPH COMPANY has two improved machines on the market. One is an automatic Addressograph that prints through a ribbon like other standard office appliances and thus makes an impression like that of a typewriter. It is intended particularly for large users of direct-mail advertising but can be used effectively by any concern with a large mailing list. A speed of 7000 addresses an hour can be attained.

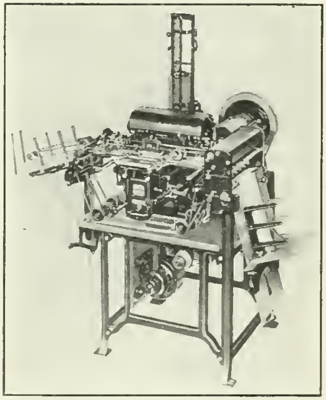


FIG. 1 AUTOMATIC ADDRESSING MACHINE

The other improved machine is a Graphotype that has been equipped with a standard typewriter keyboard. It works easily and with nearly as much speed as can be attained on an ordinary typewriter, so that plates can be embossed considerably faster than with previous models.

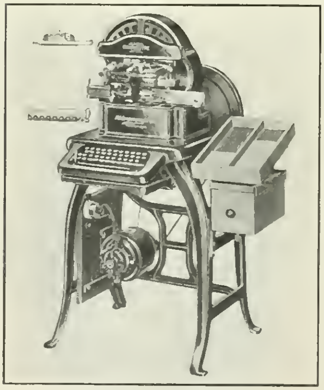


FIG. 2 GRAPHOTYPE MACHINE

The Addressograph Company also has developed two new address plates. One contains a complete 3-line index card bearing the imprint of the entire plate itself. The other has a capacity of 8 lines, permitting a considerable amount of data to be embossed on it.

Filing Safe

Index Number 651.16 Safes

A NEW filing safe is being manufactured by the Van Dorn Iron Works Company. This safe, known as the "5950" line, has three hinges of a new design which permit the door to lay flat back against the side, as well as being of very neat design. A new top plate has been added, the sides are smooth, and four swivel castors make it easy to move the safe in any direction.

The combination lock has a safety trigger or guard to prevent opening the safe even though the lock is practically destroyed. The handles have black rubber grips, and are strongly made. The safes are made in four standard sizes and can be fitted with any interior Van Dorn units.

Conductor Cable Reel

Index Number 621.863 Cable reels

THE Mogul Type Reelite, manufactured by Appleton Electric Company, is an automatic reel for holding, paying out, and retrieving cable used to furnish power for all sorts of portable machinery. It can be incorporated in new machinery or attached to existing devices. By its use cable is kept clean and unkinked and the annoyance of dragging loose cable over floors cluttered up with machinery, trucks, etc., is eliminated.

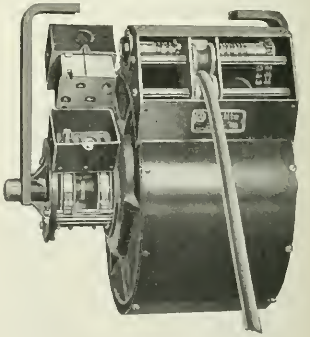


FIG. I CONDUCTOR CABLE REEL

It consists of a drum mounted in a steel box which protects the reeled cable. The cable is easily unreeled as the machine is moved away from the power connection and is automatically re-reeled as the machine is moved toward the outlet.

"Micarta in the Central Station" is the title of a new bulletin issued by Westinghouse Electric and Manufacturing Company. It describes the applications in which standard forms of micarta may be used for insulating purposes. Contains brief descriptions of various grades and forms in which micarta can be obtained.

CURRENT INFORMATION INDEX
FOR THE MANAGEMENT

The material indexed in this department is selected by the editors of MANAGEMENT AND ADMINISTRATION from upwards of 150 magazines; it also includes the publications of some 50 book publishers and professional societies as far as these are of managerial interest to industrial executives. The items are prepared and classified by the Engineering Societies Library in New York City. The decimal number at the right of each item is the index number and indicates the place the article or book will take when filed in accordance therewith in the classified subject scheme. If articles are grouped according to these numbers, like subjects will automatically fall together and related subjects will follow in logical sequence. Photostat copies of any magazine article indexed can be supplied by The Ronald Press Company at a price of 25 cents the page. When ordering photostats please identify the article by quoting from the index: (1) Title of article; (2) Index number; (3) Name, date, volume number, and page number of periodical in which the item appears. A remittance of 25 cents a page should accompany the order. The books and pamphlets indexed can be procured from The Ronald Press Company or from their respective publishers.

Accounting

Analyzing Statements of Operating Results. 657.452
George S. Cremer and William R. Drachbar. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 507-508. A method for analysis is carefully outlined and charts presented designed to aid the tabulating of differences between the present and previous years and changes resulting therefrom.

Balance Sheet Analysis. 657.372
Alexander Wall. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 521-524.

Correct Costs at Little Expense. 657.452
Gaylord G. Thompson. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 517-520. A system for the small and medium size plant.

The Development of Costing. 657.452
F. C. Lawrence. *Business Organization and Management*, October 1924, v. 11, pp. 37-42. Development of the science of cost accounting and what it should mean to the industrial executive.

Distributing the Overhead. 657.441
National Association of Cost Accountants. *Official Publications*, October 15, 1924, v. 6, no. 4, 11 pp. Methods of distributing fixed, direct, and maintenance charges and of distributing the general overhead to the producing departments.

Principles of Auditing. 657.7
Eric L. Kohler, C. P. A., and Paul W. Pettengill, C. P. A. A. W. Shaw Co., Chicago. 231 pp. $4. Gives the complete procedure necessary for making an audit of a business to provide information about its financial condition and earnings for use of its officers, stockholders, bankers or investors. The exposition proceeds in an orderly manner from the start of an audit, through the methods of auditing all the various accounts of a business, to the closing of the audit and the preparation of the exhibits, certificates, and audit report. A complete set of working papers obtained from an actual situation has been included in the book. Although intended primarily as a textbook, business men wishing to learn something about auditing will find in this book a clear and detailed exposition of the subject.

Use of Budgets in Reducing Overhead. 657.452
National Association of Cost Accountants, *Official Publications*, October 1, 1924, v. 6, 7 pp. Discusses cost data and daily budget analysis, how they are arrived at, and what use may be made of them.

Advertising

Advertising, a Factor in Molding Public Opinion. 659.1
P. L. Thomson. *Railway Age*, October 18, 1924, v. 77, pp. 699-701. Emphasizes particularly the need for advertising the public utilities and their power for good.

Problems of Sales Development. 659.131
Max Rittenberg. *Sales Management* (England), October 15, 1924, v. 4, pp. 517-518. The cumulative effect of a succession of advertisements of a given article in a trade journal.

Selling to the Technical Consultant. 659.1
H. N. Munro. *Sales Management* (England), September 15, 1924, v. 4, pp. 467-468. How to get the consultant's attention through personal approach or advertising.

Building

Cost Analysis of Various Types of Fireproof Construction. 658.2
A. F. Klein. *Buildings*, October 1924, v. 62, pp. 904-914. Diagrs. Considers the possible types for the sixteen-story-and-basement hotel, the six-story-and-basement light manufacturing building, and the warehouse eight-story-and-basement building. Includes cost analysis forms to accompany each type.

Factory and Office Illumination: 1—The Need for Good Industrial Lighting. 658.242
L. Gaster. *Business Organization and Management*, October 1924, v. 11, pp. 23-26. Illus.

Keeping Pace with Auto Output. 658.2
The Foundry, September 15, 1924, v. 52, pp. 718-725. Illus. Plant layout of the Wilson Foundry and Machine Co., Pontiac, Mich. Diagrams and description show routing systems, conveyors used, special devices used in production processes, etc.

Lighting and Ventilating System of the New Studebaker Foundry. 658.24
Buildings, October 1924, v. 62, pp. 937-938. Illus. The building is enclosed in 200,000 square feet of windows by means of which lighting and ventilation are made possible.

Modern Maintenance of Plant and Equipment: 2—The Factory Heating System. 658.25
W. G. Ziegler. *Industrial Management*, October 1924, v. 68, pp. 244-249. Illus. Points to be considered in installation, maintenance, and control.

Tunnels Facilitate Handling of Material in New Foundry. 658.2
Pat Dwyer. *The Foundry*, October 15, 1924, v. 52, pp. 806-812. Illus. Detailed description of the Studebaker Foundry at South Bend, Ind., showing by illustration and diagram the straight flow of material from its raw state to the completed product. Discusses construction features, including lighting, ventilation, roofing and types of floors.

Economics

Elements of Business Statistics. 31
Robert Riegel, Ph. D. Appleton and Company, New York. 549 pp. $4. A discussion of statistical methods, including their collection, interpretation, and presentation, that are particularly applicable to the solution of business problems. Not many new ideas are presented but many old ones are set forth in a way which is considerably more lucid than that generally adopted in other works on the subject. This is particularly true of the discussions of the more technical subjects such as ratios, averages, dispersion, correlation, etc., which are treated in a manner easily understandable by readers without a technical education. Nearly every sort of statistical method is discussed and connected with its application to business by practical illustrations. It should be of considerable value to all business men as an aid in improving their statistical methods.

Finding Your Industry's Cycle—Industrial Budget Methods—2. 338.97
Joseph H. Barber. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp.

479-486. Charts. Outlines the methods of quantitatively analyzing the particular cycles (of orders, of shipments, of collections, etc.) of the particular business.

German Prices and German Competition in International Markets. 38(43)
Joseph Hellauer. *Harvard Business Review*, October 1924, v. 3, pp. 35-53. Post-war conditions in the economic life of Germany, due to depreciated currency, effects of differences between domestic and foreign money values, and a consideration of German industry and its prospects.

Labor Attitudes and Problems. 331
W. E. Atkins and H. D. Lasswell. Prentice Hall, Inc., New York. 520 pp. $5. The general purpose of this book has been to present a picture of the conditions under which laborers in various industries work in an effort to understand their attitudes toward economic questions. The first section of the book describes the conditions in various major industries such as coal, steel and agriculture. The next section is an estimate of the influence of machine production on the worker. Following this are discussed standards of living, the struggle to attain a definite economic and social status, and the influence of public control. The book is written in an interesting style and should be instructive to all who have employees, or who are interested in them.

New Measures of the Business Cycle. 338.97
Carl Snyder. *Harvard Business Review*, October 1924, v. 3, pp. 1-7. A composite index, for a period of fifty years, of practically all business activity based on a study of price levels and volume of trade, makes possible the determination of lines of normal growth and the probable normal point for current months.

State vs. Private Ownership of Electric Utilities. 350.72
A. T. Hadley. *National Electric Light Association Bulletin*, October 1924, v. 11, pp. 613-617. Review, with the conclusion that electric power generation should not become a government monopoly.

Things to Tell Your Men: 8—Stocks and Bond Brokers. 332
E. Roberts. *The Nation's Business*, November 1924, v. 12, pp. 52, 54. Defines the terms: investment, fixed and circulating capital, common stock, preferred stock, bonds, mortgage, and makes various explanations concerning common financial transactions.

Financial Control

Balance Sheet Analysis. 658.14
Alexander Wall. Management and Administration, November 1924, v. 8, pp. 521-524.

Budget Methods of Metal Product Company. 658.14
Iron Age, October 9, 1924, v. 114, pp. 910-912. Sales forecasted, production program planned, and selling expense, advertising and administration budgeted.

Correct Costs at Little Expense. 658.14
Gaylord G. Thompson. Management and Administration, November 1924, v. 8, pp. 517-520. A system for the small and medium size plant.

Inventory Valuation and the Business Cycle. 658.14
H. T. Warshow. *Harvard Business Review*, October 1924, v. 3, pp. 27-34. Elimination of undue fluctuations of inventory values and stabilization of profits and losses of an industry over a period of years, brought about by the use of the "normal stock" method. The amount of stock needed on hand to conduct the business at all times is considered as part of equipment and valued at a constant comparatively low price.

Organizing a Business for Cost Reduction. 658.14
J. H. Van Deventer. *Industrial Management*, October 1924, v. 68, pp. 193-220. The relation of the cost department to executive control and cost reduction. A statistical summary and abstract of returns to a questionnaire on the utilization of cost data sent out to American industrial concerns. Includes such questions as the relation of the cost department to control of materials and compilation and distribution of overhead, use of cost data to prevent excessive costs, how foremen are brought in touch with cost and expense records, how cost analysis dictates programs of economies, the use of cost data for executive control.

Significance of the Budget. 658.14
Metropolitan Life Insurance Co. Business leaflet no. 10, October 1924. 15 pp. The budget as a controlling factor in government and especially in business. How the Policyholders' Service Bureau of this company serves as clearing house of all kinds of budget information.

Fuel

Auxiliary Equipment for Oil Burning. 662.75
Kester Miller. *Fuels and Furnaces*, October 1924, v. 2, pp. 1047-1054. Classification of blowers and compressors and discussion of fan characteristics.

By-Product Coking in Alabama. 662.74
F. W. Miller. *Mining and Metallurgy*, October 1924, v. 5, pp. 475-477. Advantages of by-product ovens for producing coke for the blast furnace industry.

Coal Storage and the Railroads. 662.65
R. H. Aishton. Management and Administration, November 1924, v. 8, pp. 473-474. Urges preventing coal shortage in winter through buying and storing it during the summer months. Discusses transportation problems and exonerates the railroads from any responsibility for coal shortage.

Combustion Devices for Gaseous Fuels. 662.76
W. Trinks. *Fuels and Furnaces*, October 1924, v. 2, pp. 1035-1038. Classification and description of the types mixing gas and air inside the furnace.

Heat Production and Heat Balances of Furnaces, Especially for Low-Grade Fuels. 662.6
(Wärmeerzeugung und Wärmebilanzen von Feuerungen besonders für minderwertige Brennstoffe). Fr. Ebee. *Zeitschrift des Vereines Deutscher Ingenieure*, October 18, 1924, v. 68, pp. 1106-1108.

Overcoming Operating Troubles in Modern Power Plants. 662.65
J. W. Mackenzie. *Steam Power*, October 1924, v. 3, pp. 7, 10. Methods of preventing coal pile fires and various clinker troubles.

Practical Coal Carbonization. 662.74
A. R. Powell. *Universal Engineer*, October 1924, v. 40, pp. 25-33. Illus. Diagrs. Low-temperature carbonization and a classification and description of the various processes.

Purchase of Coal by the Railroads. 662.65
F. R. Wadleigh. *Steam Coal Buyer*, October 1924, v. 2, pp. 15-17. Points out the need of more scientific methods of sale and purchasing of coal.

Use of Pulverized Fuel for Steam Raising in Germany. 662.65
(Stand der Kohlenstaubfeuerung für Dampfkessel in Deutschland). Schulte. *Zeitschrift des Vereines Deutscher Ingenieure*, October 11, 1924, v. 68, pp. 1071-1074. Diagr.

Industrial Methods

Airless Injection Oil Engines. 2. 621.43
H. F. Birnie and R. C. Baumann. *Power Plant Engineering*, October 15, 1924, v. 28, pp. 1056-1058. Illus. The Worthington two cycle model, an example of indirect injection through use of divided combustion chamber.

Applications of Fans and Blowers to the Clay-Working Plant. 621.6
C. V. Saunders. *Brick and Clay Record*, September 30, 1924, v. 65, pp. 470, 472, 474.

Arc Welding in Ship Building. 621.3923
A. G. Bissell. *The Welding Engineer*, October 1924, v. 9, pp. 28-29. Illus.

Coal Washing Practice in Alabama. 622.78
H. S. Geismer. *Coal Mine Management*, October 1924, v. 3, pp. 23-33, 60.

A Critical Review of Air Hammers. 621.97
(Kritische Betrachtungen über Lufthämmer). W. Baron. *Werkstattstechnik*, October 15, 1924, v. 18, pp. 565-567.

Cutting Manufacturing Costs by Means of the Oxy-Acetylene Blowpipe. 665.882
George E. Hagemann. Management and Administration, November 1924, v. 8, pp. 509-512. Illus.

Electric Furnaces for Medium Temperatures. 621.365
C. F. Cone. *Forging-Stamping-Heat Treating*, October 1924, v. 10, pp. 375-379. Illus. Description of the regenerative car type furnace employed for annealing purposes.

Hydraulic Riveting in Boiler Construction. 621.18
(Neuzeitliche Forderungen an die Hydraulische Kesselnietung und die möglichkeiten ihrer Erfüllung in der Praxis). H. Müller. *Werkstattstechnik*, October 1, 1924, v. 18, pp. 539-543.

Metal Cutting Methods. 665.882
(Die Wirtschaftlichkeit der Trennverfahren). Kammerer u. M. W. Gleich. *Maschinenbau*, September 11, 1924, v. 3, pp. 863-865. Diagrs.

Multiple System of Electric Melting. 669.187
E. A. Hauff. *The Iron Age*, October 16, 1924, v. 114, pp. 999-1003. Illus. Value of electric furnace in steel production.

The Perfection of Cutting Machines Brought to Highest Efficiency and the Probable Effect on Production in Rolling Mills. 621.94
(Die Richtige Ausbildung der Meiszelschneide und ihr wirtschaftlicher Einflusz auf die Arbeit in einem zeitgemäsz Eingerichteten Hüttenwerk). H. J. Stoewer. *Werkstattstechnik*, v. 18, September 15, 1924, pp. 484-486, October 1, 1924, pp. 522-526.

Precision Mechanism and Machine Construction. 621.7163
(Feinmechanik und Maschinenbau). O. Richter. *Zeitschrift des Vereines Deutscher Ingenieure*, October 18, 1924, v. 68, pp. 1089-1092.

Principles of Business Conduct in the Face Brick Industry. 174
R. D. T. Hollowell. *Brick and Clay Record*, October 14, 1924, v. 65, pp. 524-528.

Putting Locomotive Cranes to Work. 621.87
George E. Titcomb. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 475-478. Illus. Different types of locomotive cranes and their special equipment.

Reconstruction of Wasteful Lathes. 621.94
(Über unwirtschaftliche Drehbänke und ihren Umbau). M. Kronenberg. *Werkstattstechnik*, September 15, 1924, v. 18, pp. 495-498.

Specifications for Pipe Coverings. 621.774
Hubert E. Collins. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 503-506. How to specify quantity and size of insulation. Discusses efficiencies of different coverings for steam, hot water and refrigerating pipes.

Transactions Index. Vols. 1-45. 62(016)
The American Society of Mechanical Engineers. New York. 222 pp. $3. A general index of the transactions of the Society—the first that has been published since Volume 27. An attempt has been made to index not only the major subjects of formal papers but also other subjects treated in the papers and in discussions. Since Volume 27 contained a general index for previous volumes the foregoing applies only to Volumes 26 to 45. Only major subjects and their authors for the first 25 volumes are indexed in the present work. In arrangement the general style of The Engineering Index has been followed—grouping alphabetically all items under authors' names and subjects.

Maintenance

Maintenance: Gearing Up Both Plant and Equipment for Low-Cost Production. 658.58
K. D. Hamilton. *Factory*, October 1924, v. 33, pp. 498-501, 570. Diagr. Organization of engineering department. Gives several organization charts and discusses in detail the work that should be under the supervision of this department.

New Methods of Machine Maintenance and Repair. 658.581
(Neue Wege für die Reklame in Maschinenbau). W. Benedict. *Maschinenbau*, September 22, 1924, v. 3, pp. 918-920.

Paint as a Rust Preventative. 658.58
R. C. Sheeler. *Industrial Management*, October 1924, v. 68, pp. 229-232. The importance of paint in the upkeep of industrial buildings and equipment. Suggestions for roofing, smoke stacks, tanks, boiler rooms, etc.

Reducing Production Costs: 2—Replacing Machine Tools. 658.581
H. Varley. *Cassier's Industrial Management*, October 1924, v. 11, pp. 437-440. Tables. Helpful suggestions and cost figures to be applied in making decisions as to replacing or repairing machinery.

Seasonable Work in Preparation for Winter. 658.58
Textile World, November 1, 1924, v. 66, pp. 61, 63, 77. Illus. How textile mills can prepare for winter by examining their hydrants, sprinkler systems, mill yards, steam pipes, pumps, etc., as a protection against fire and accident hazards and losses from fuel and operation.

Management

Getting the Executive Program Across—Building Tractors Under Scientific Management—VI. 658.1
George D. Babcock. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 497-502. Problems of the executive and how the information necessary to preplanning the work of the next year may be collected.

Organization for Successful Operation. 658.1
B. A. Franklin. MANAGEMENT AND ADMINISTRATION. November 1924, v. 8, pp. 513-516. Methods to be followed for the upbuilding of an industrial organization. Discusses policies of personnel promotion and the problem of the executive to select and train a satisfactory successor to himself.

Management of Special Industries

Electricity in the Ceramic Industries. 658.9:666
A. B. Searle. *World Power*, October 1924, v. 2, pp. 226-231. Illus. A consideration of its advantages as a source of power, heat and light, and as a means for purifying ceramic materials.

Management of the Work of the German State Railroad. 658.9:656.2
(Werkwirtschaft der Deutschen Reichsbahn). Kühne. *Maschinenbau*, Septembre 11, 1924, v. 3, pp. 845-850. Diagr.

The Manufacture of Glazed Tiles. 658.9:666.7
A. Simon. *Engineering Progress*, October 1924, v. 5, pp. 214-219. Illus. Equipment and functioning of the crushing plant, mass mill, drying oven, and grinding and glazing departments of a modern tile works.

Operation Planning Necessary to Fill Hot Stamping Contracts. 658.9:621.73
(Die Vorausbestimmung der Anzahl von Warmpreszwerkzeugen zur Erledignng eines Warmpreszauftrages). E. Kaczmarek. *Werkstattstechnik*, October 15, 1924, v. 18, pp. 584-585.

Reducing Operation Costs in the Forge Shop. 658.9:621.73
(Verminderung der Betriebskosten in der Schmiede). Georg Bock. *Werkstattstechnik*, October 15, 1924, v. 18, pp. 577-579. Eliminating the cost of unproductive machine power.

Sand and Gravel Company Expands Concrete Block Department. 658.9:622.312
C. B. Dutton and H. C. Shields. *Cement, Mill and Quarry*, October 20, 1924, v. 25, pp. 29-34. Illus. The process of converting the waste products and surplus stock of sand, gravel and crushed rock into concrete masonry units as practiced by the Otto Ludwig Block Co., indicating also the economic advantages in developing the by-product.

Time Record in Rebuilding Box Cars. 658.9:625.2
A. C. L. R. R. Railway Review, October 11, 1924, v. 75, pp. 533-537. Illus. The results of a time record contest, indicating the advantages of the progressive repair system, or the straight line or station-to-station method of repairing and rebuilding.

Tunnels Facilitate Handling of Material in New Foundry. 658.9:621.72
Pat Dwyer. *The Foundry*, October 15, 1924, v. 52, pp. 806-812. Illus. Detailed description of the Studebaker Foundry at South Bend, Ind., showing by illustration and diagram the straight flow of material from its raw state to the completed product. Discusses construction features, including lighting, ventilation, roofing and types of floors.

Westinghouse at Work. 658.9:621.3
C. H. Schryer, Jr. *Central Manufacturing District Magazine*, November 1924, v. 8, pp. 73-77. Illus. Describes the new seven-story warehouse, assembly plant and repair shop of the Chicago branch which serves the entire Middle West.

Material Control

Coal Storage and the Railroads. 658.78:662.65
R. H. Aishton. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 473-474. Urges preventing coal shortage in winter through buying and storing it during the summer months. Discusses transportation problems and exonerates the railroads from any responsibility for coal shortage.

Comparison of Flat and Round Strapping. 658.78844
W. H. Sacket. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 525-

526. Describes tests made with different types of metal strappings on wooden shipping boxes by the Forest Products Laboratory, Madison, Wis.

Eleven Packing Problems and How They Were Solved. 658.78844
H. N. Knowlton. *Factory*, October 1924, v. 33, pp. 515-519, 590. Wooden crates illustrated and described.

Price Is Only One of the Elements Involved in Profitable Buying. 658.7
Harry Tipper. *Automotive Industries*, October 30, 1924, v. 51, pp. 778-780. Chart. Factors entering into a purchase are: price, quality, uniformity, regularity of delivery, stability of supply sources.

Purchase, Storage, and Distribution of Lubricants. 658.78
Henry Freeman. *Industrial Engineer*, October 1924, v. 82, pp. 475-477. Savings effected by the Allis-Chalmers Manufacturing Co. by bulk purchase and storage and by daily delivery by electric truck to the various departments.

Mechanical Handling

Conveyor Plants for Modern Manufacturing Processes. 658.281
Hauck. *Engineering Progress*, October 1924, v. 5, pp. 219-223. Illus. Discusses the advantages of the numerous mechanical conveyor systems as time- and money-saving devices. Well illustrated.

In Moving Materials We Find a Double Saving. 658.28
P. M. Duesing. *Factory*, October 1924, v. 33, pp. 507-511, 588. Labor-saving devices for material handling in transportation and productive processes.

Industrial Transportation. 658.281
R. B. Williams. *The Blast Furnace and Steel Plant*, October 1924, v. 12, pp. 456-459. Illus. Electric hoists, gasoline or electric truck tractors, and lift trucks, suggested as vehicles of transportation for handling material.

Modern Locomotive Coaling Stations. 658.281:662.65
(Einige neuzeitliche Lokomotiv-Bekohlungsanlagen). B. Garlepp. *Maschinenbau*, September 22, 1924, v. 3, pp. 890-894. Diagr.

Multiplied Manpower and Simplified Handling. 658.281
M. W. Potts. *Industrial Management*, October 1924, v. 68, pp. 221-228. Illus. The hand lift truck system, consisting of a hand lift truck and a number of load platforms or skids. Shows how they can fit into almost any plant, and be a means of greatly reducing expenses of rehandling.

The Pressed Steel Truck Platform. 658.281
M. V. Trevor. *Forging-Stamping-Heat Treating*, October 1924, v. 10, pp. 393-395. Illus. A comparison with the wooden box trucks for material handling, indicating the advantages of the steel truck.

Putting Locomotive Cranes to Work. 658.281
George E. Titcomb. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 475-478. Discusses material-handling problems and special equipment for locomotive cranes.

Swing-or-Finger-Tray Elevator for Handling Fresh Fruit in Crates, Barrels and Cases. 658.2812
G. F. Zimmer. *Cassier's Industrial Management*, October 1924, v. 11, pp. 445-447.

Personnel

For Encouragement of Craftsmanship. 658.314
Buildings, October 1924, v. 62, pp. 900-901. The plan initiated by the Philadelphia building congress, whereby a certificate of award will be given to the common and unskilled laborers and helpers who have displayed aptitude and efficiency in performing their tasks as construction workmen.

Health Service Work in Paper Mills. 658.3822
L. H. Freehtling. *Paper Trade Journal*, October 2, 1924, v. 79, pp. 36, 38, 55. Physical examinations, education, nursing service, sanitation, ventilation.

Industrial Relations. 658.3
R. E. Tally. *Mining and Metallurgy*, October 1924, v. 5, pp. 478-480. Factors which influence relations between employer and employee—the importance of well-chosen organization heads and bosses, interest in the welfare of employees, etc.

Management of Men: a New Idea. 658.31242
W. J. Hiseox. *Mechanical World* (England), October 10, 1924, v. 76, pp. 229-230. Suggests having an unofficial investigator to make suggestions to co-workers and to aid in the removal of grievances as they are brought to him in an unofficial capacity.

Principles and Technique of Preparing an Occupational Classification of Positions in the Public Service. 658.3124
E. O. Griffenhagen. *Public Personnel Studies*, November 1924, v. 2, pp. 240-253. Methods of obtaining information for classification, the use of questionnaires, the practical steps involved in grouping and arranging positions, and the important uses to which the resulting classification can be put.

The Relation of Medicine to Industry. 658.3822
National Industrial Conference Board, New York. 88 pp. $1. Proceedings at the tenth anniversary meeting of Conference Board of Physicians in Industry. Thirteen addresses covering the entire range of the relation of medicine to industry are reported in full. The collection presents a clear picture of what may be expected from industrial medicine and what has already been done toward the promotion of health of industrial workers.

Suggestions for Developing Co-operation. 658.3
A. B. Tunis. *Railway Age*, October 11, 1924, v. 77, pp. 633-634. Points out the need for offering satisfactory wages and capable heads of departments, and for working out health, recreation, and welfare programs in the railroad systems.

Unemployment Relief in Great Britain. 658.3253
Felix Morley. Houghton Mifflin Company, Boston. 203 pp. $2. A critical discussion of the various methods of unemployment relief that have been tried in Great Britain with an estimate of their value for the future. State controlled unemployment insurance has been in force for a number of years but the author believes it has outlived whatever usefulness it may have had and should be replaced. A strong movement appears to be gaining momentum to the end that state controlled insurance be replaced by insurance by industry. The subject discussed is of particular interest to American business men, since unemployment problems will demand increasing attention in the future. Such an understanding of the subject as can be gained from this outline of British experience will be very valuable in determining American methods of procedure.

Power and Power Plants

Calculation of the Boiler Heat Balance. 621.18
Power Plant Engineering, October 1, 1924, v. 28, pp. 991-995. Diagrs. How to conduct boiler efficiency tests as an aid in eliminating losses.

Combustion Control for Boilers. 621.182
R. J. S. Pigott. *Mechanical Engineering*, October 1924, v. 46, pp. 590-592. Diagr.

Conditions Affecting Steam Turbine Economy. 621.165
J. Y. Dahlstrand. *Power Plant Engineering*, October 15, 1924, v. 28, pp. 1041-1043. Conditions which interfere with high economy in steam turbines, how the designer can to some degree forestall these causes, suggestions for operators.

Dividends for Dull Times. 658.26
D. M. Myers. MANAGEMENT AND ADMINISTRATION, October 1924, v. 8, pp. 417-419. Management and cost-keeping records in the power plant may result in great savings.

Effect of Back Pressure in Steam Turbines. 621.165
(Das Gegendruckverfahren und seine Anwendung bie der Dampfturbine). G. Zerkowitz. *Zeitschrift des Vereines Deutscher Ingenieure*, September 27, 1924, v. 68, pp. 1026-1030. Diagr. Discusses also recent turbine designs.

Efficiency in Steam Power Plant Operation. 621.18
L. M. Arkley. *The Engineering Journal*, October 1924, v. 7, pp. 635-638. Periodic tests of boiler efficiency, and analysis of flue gases; how to make tests and apply results to improving operation conditions.

Excessive Use of Boiler Fuel. 621.18
C. L. C. Kah. *The Gas Industry*, October 1924, v. 24, pp. 361-362. Unnecessary expenses incurred by unsatisfactory boiler plant equipment and by wasteful and inefficient use of steam.

Experiences with Waste Heat Boilers Behind Open Hearth Furnaces. 621.18
W. S. Donawitz. *The Blast Furnace and*

Steel Plant, October 1924, v. 12, pp. 474-475. Diagr.

Fundamentals of Combustion Control. 621.182
E. G. Bailey. *Power Plant Engineering*, October 15, 1924, v. 28, pp. 1044-1048. The essential factors of control: rate of fuel feed, amount of forced and induced draft. Equipment needed.

Group Versus Individual Drives. 658.26
C. H. S. Tupholme. *Mechanical World*, October 24, 1924, v. 76, pp. 261-262.

How Belting Was Standardized in Large Automotive Plant, 4-5. 658.2621
H. A. Flogaus. *Belting, Transmission, Tools and Supplies*, v. 25, September 1924, pp. 25-27; October 1924, pp. 23-25. Illus. Discusses the reclamation of leather and rubber belting, the effect of shaft misalignment on belt life, and the economic advantage of crown pulleys, cross belt and quarter twist drives.

Modern Tendencies in Steam-Turbine Power Plants. 621.165
Eskil Berg and F. V. Smith. *Mechanical Engineering*, October 1924, v. 46, pp. 577-582. Diagrs. High pressure, superheat, reheating, and steam extraction as affecting power-plant economy, and the advantages obtained in their adoption.

Ruths Steam Accumulator. 621.186
J. Ruths. *Paper*, October 9, 1924, v. 34, pp. 1138-1142. Diagr. Principle of the invention whereby steam is stored in water under increasing pressure and discharged under falling pressure.

The Steam Engine as a Stoker Drive. 621.1841
Power Plant Engineering, October 1, 1924, v. 28, pp. 1000-1002. Illus.

Steel Company Builds New Power Plant. 621.311
Power Plant Engineering, October 15, 1924, v. 28, pp. 1034-1041. Illus. Detailed account of the equipment in the power plant operated by the Columbia Steel Corporation to furnish electric power and steam to their blast furnace and coke plant at Provo, Utah.

Two-Score Years in Power Development. 621.101
F. R. Low. *National Engineer*, October 1924, v. 28, pp. 473-478. Illus. Historical review since organization of the N. A. S. E. Comparison of the modern power plant with that of forty years ago.

Use of Diesel Engines in Power Plants. 658.26
L. R. Ford. *Power Plant Engineering*, October 1, 1924, v. 28, pp. 1003-1004. A comparison of the Diesel engine with that of the steam engine, noting the advantages of the former.

The Use of Welding in Power Plant Piping. 658.26
L. J. Sforzini. *Modern Mining*, September 1924, v. 1, pp. 45-49. Illus. Diagrs.

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Care and Maintenance of Pneumatic Tools. 658.563
C. B. Beingarten. *Railway Review*, October 18, 1924, v. 75, pp. 596-597.

Handling the Jobbing Order. 658.51
E. W. Leach and J. F. Koch. *American Machinist*, October 16, 1924, v. 61, pp. 603-607. Suggests a method for recording and following up jobbing orders in an average size machine shop. Includes forms to illustrate method of procedure.

Operation Planning Necessary to Fill Hot Stamping Contracts. 658.51
(Die Vorausbestimmung der Anzahl von Warmpreszwerkzeugen zur Erledigung eines Warmpreszauftrages). E. Kaczmarek. *Werkstattstechnik*, October 15, 1924, v. 18, pp. 584-585.

Quality Manufacturing at Predetermined Costs. 658.5
E. F. Roberts. *Factory*, October 1924, v. 33, pp. 495-497, 544. Illus. Production increase in quantity and quality through a system of bonus payment and predetermination of costs based on standard time studies.

Report on the Handling and Disposing of Cinders. 658.567
Railway Engineering and Maintenance October 1924, v. 20, pp. 402-404; also *Railway Review*, September 27, 1924, v. 75, pp. 481-483. Recommendations as to methods and equipment, and suggestions for the use of cinders as ballast.

Sand and Gravel Company Expands Concrete Block Department. 658.5671
C. B. Dutton and H. C. Shields. *Cement, Mill and Quarry*, October 20, 1924, v. 25, pp. 29-34. Illus. The process of converting the waste products and surplus stock of sand, gravel and crushed rock into concrete masonry units as practiced by the Otto Ludwig Block Co., indicating also the economic advantages in developing the by-product.

Time Ratios in Work-Setting and Tooling. 658.542
J. H. *Mechanical World* (England), October 3, 1924, v. 76, pp. 211-212. Operation studies to reduce loss of time in work-setting.

Utilization and Prevention of Waste. 658.5671
C. B. Auel. *American Machinist*, October 30, 1924, v. 61, pp. 681-684. Interdepartment plan in use at the Western Electric Company. Standardization an important feature.

Waste — Some Ways to Eliminate It. 658.567
D. M. Raymond. *Railway Mechanical Engineer*, October 1924, v. 98, pp. 595-596. Retaining mechanics during periods of business depression and standardization of freight car parts are suggested ways of reducing waste.

Safety

Directing Attention in Safety Work. 658.3823
H. W. Donald. *Industrial Engineer*, October 1924, v. 82, pp. 478-482. Charts. The value of industrial safety standards and codes in installing safety equipment, the importance of regular inspection and of keeping the employees interested.

Eye Hazards in Industrial Occupations. 658.3823
Louis Resnick and Lewis Carris. The National Committee for the Prevention of Blindness, Inc., New York. 247 pp. $1.50. Although artificial hands, arms and legs can be obtained that do almost anything the human member can do, no one has been able to produce an artificial eye that can see. This fact emphasizes the seriousness of eye injuries and the great need for preventing them. This book is a complete, up-to-date treatise on industrial eye hazards and the means of eliminating them. The publishing organization has acted as a clearing house for the great fund of information regarding this particular hazard that has been developed by the numerous industrial associations, governmental agencies, and individual corporations interested in accident prevention and health promotion. Thus this book contains the complete sum of present knowledge regarding conservation of vision and will be very valuable to safety engineers, managers, employers and all others who share the responsibilities of protecting the life and health of industrial workers.

Guards for Woodworking Machinery. 658.283
Railway Review, October 18, 1924, v. 75, pp. 585-587. Illus. Diagrs.

The Human Element. 658.3823
J. H. Mallon. *Cement, Mill and Quarry*, October 5, 1924, v. 25, pp. 19-22. Illus. Novel methods employed by the Louisville Cement Company to enlist the human factor in accident prevention.

No-Accident-Month Campaigns. 658.3823
T. F. Halpin. *Cement, Mill and Quarry*, October 5, 1924, v. 25, pp. 23-25. A means of arousing and sustaining interest among the workmen.

Operating an Oil Refinery Without Lost Time Accidents. 658.3823
R. S. Bonsib. *National Safety News*, October 1924, v. 10, pp. 29-31. The main features of safety work among the employees at the Eagle and Camden works of the Standard Oil Co.

Safe Use of Hand and Power Trucks. 658.281
G. J. Schirch. *National Safety News*, October 1924, v. 10, pp. 27-28, 31. Hazards and their remedies, as observed through personal supervision.

Safety Code for the Protection of Industrial Workers in Foundries. 658.3823
U. S. Bureau of Labor Statistics, Bulletin no. 336, April 1923. Tentative American standard approved June 1922 by the American Engineering Standards Committee.

Safety from the Executive's Point of View. 658.3823
B. F. Affleck. *Cement, Mill and Quarry*, October 5, 1924, v. 25, pp. 16-18. The executive must not only choose the safest way of performing work, but he must also create among employees an atmosphere of personal responsibility and co-operation.

There's a Reason for Safety at the Postum Plant. 658.3823
C. T. Fish. *National Safety News*, October 1924, v. 10, pp. 17-20. Reduction of

accidents due to careful planning and coordinated efforts of the management, the engineering department, and the safety committee.

Selling

Analysis of Salesmen's Quotas. 658.808
A. R. Burnet. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 487-490. Charts. How to arrive at an equitable determination of sales quotas. Gives graphic presentation and explains value of the progressive quota.

Export Problems. 382
J. A. Dunnage. *Sales Management* (England), October 15, 1924, v. 4, pp. 520, 522, 524. Functions of the buying agent, merchant shipper, and export agent. Points to be considered by a concern desiring direct export.

The Four Fundamentals of Sales Development. 658.82
P. B. Zimmerman. *System*, October 1924, v. 46, pp. 446-447, 506. Illus. Increasing sales by means of window and store displays, store chats to customers about the product, and outside activities covering advertising, canvassing and mail campaigns. Method used by the National Lamp Works.

How I Select My Selling Staff. 658.81
Sales Management (England), October 15, 1924, v. 4, pp. 526, 528, 530. Emphasizes the importance of selecting salesmen who shall be suitable to uphold the firm's prestige. Qualifications which are essential.

How to Analyze Sales Problems. 658.81
C. C. Casey. *Printers' Ink Monthly*, October 1924, v. 9, pp. 43-44. Suggestions of how to solve sales problems. Organization of department, selection of men, standardization of material and other points are discussed.

Is Consignment Selling the Way Out? 658.832
Roland Cole. *Printers' Ink*, October 16, 1924, v. 129, pp. 3-4, 6. Author admits that this method is not the way out, in general, but cites instances where the consignment method of merchandising has operated successfully.

The Pulse of the Pacific Market. 382
A. A. Young. *Central Manufacturing District Magazine*, October 1924, v. 8, pp. 43-49. Discusses China as a growing market for American manufacturers, and her possibilities of foreign enterprise.

Reducing Sales Arguments to the One Best Talking Point. 658.85
J. A. Murphy. *Printers' Ink Monthly*, October 1924, v. 9, pp. 29-30, 120. Illus. Every buyer is interested in some specific point of the merchandise to be sold, almost never in all of its good points. Supplemented with trade-marks illustrating value of this theory.

The Responsibility for Turnover. 658.87
Roy Dickinson. *Printers' Ink Monthly*, October 1924, v. 9, pp. 19-20, 104. Better co-operation between manufacturer and retailer would cause greater turnover of merchandise. Manufacturer is responsible for his dealer's buying habit and thus aids or handicaps the retailer's selling ability.

The Retail Handbook. 658.87
Walter S. Hayward. McGraw-Hill Book Company, Inc., New York. 617 pp. $5. The principles and practices of retailing as applied to all merchandising establishments whether large or small. Includes information concerning store layout, location, and equipment, organization, merchandising, display, advertising, mail order selling, credits and collections, financing, accounting, and research. Should be valuable to manufacturers who sell at retail and also to those who wish to assist in the sale of their products.

Sales Records and Their Relation to Sales Promotion. 658.817
W. A. Staving. *Printers' Ink Monthly*, October 1924, v. 9, pp. 26-28. Sales analysis and sales records found necessary in a highly competitive industry. Details of system are described.

Salesmanship. 658.85
E. E. Ferris and G. R. Collins. The Ronald Press Company, New York. 414 pp. $3. A comprehensive study of the factors that influence success in selling. Especial emphasis has been placed on analysis of all the various elements that enter into sales work. The general method of treating each element has been as follows: (1) definition of principles involved; (2) brief outline of rules and methods generally used; (3) detailed report and discussion of specific instances illustrating the most effective practice; (4) problems to be solved. The book covers all phases of selling work and the practical examples given are especially valuable in interpreting the text to the reader. It should be of considerable value to all who are connected with selling work.

Setting Sales Quotas—Working Plans for Profits—2. 658.808
G. Charter Harrison. MANAGEMENT AND ADMINISTRATION, November 1924, v. 8, pp. 491-495. Determining the volume of sales to be realized. Quotes Henry Ford and John H. Patterson on disregarding the business cycle. Cites some unusually successful cases of sales increase and methods employed to obtain them.

Should the Salesman Be His Own Salesmanager? 658.811
Don Gridley. *Printers' Ink Monthly*, October 1924, v. 9, pp. 39-40, 80. Pros and cons of salesmen management with quotations from sales managers' experiences.

What the Sales Manager Told the Salesman. 658.85
Sales Management (England), October 15, 1924, v. 4, pp. 519, 534, 536. Points to be kept in mind by the salesman—reports, prospects, appearance and approach, etc.

Standardization

Economical Manufacture of Goods Trucks. 658.516
Werner. *Engineering Progress*, September 1924, v. 5, pp. 189-190. The value of exchangeability of parts in car and truck manufacture. Cites practice of German State Railway.

Effect of Standardization and Specialization on Material Supply and Capital. 658.516
(Einfluss der Normung und Spezialisierung auf Lagerhaltung und Kapitalbedarf). Schulz-Mehrin. *Maschinenbau*, September 22, 1924, v. 3, pp. 920-921.

Effects of Standardization on Individuality. 658.516
L. D. Burlingame. *Canadian Machinery*, October 2, 1924, v. 32, pp. 28-30, 54. The danger of overstandardization in the machine tool industry if gone into without due regard to established practice.

Freight Car Construction. 62(003)
(Wirtschaftliche Fertigung im Güterwagenbau). Werner. *Werkstattstechnik*, October 1, 1924, v. 18, pp. 521-522. Discusses interchangeability of parts in freight car construction and repair.

Standardization in Germany. 62(003)
(Die Normung in Deutschland). F. Neuhaus. *Zeitschrift des Vereines Deutscher Ingenieure*, October 11, 1924, v. 68, pp. 1065-1070. Diagr.

Training

Sponsor Industrial Leadership. 658.386
H. B. Bliss. *Michigan Manufacturer and Financial Record*, November 1, 1924, v. 34, pp. 3, 24. Direct training of employees for executive positions through co-operation of Lansing manufacturers with the industrial training department of the Lansing Y. M. C. A.

Teach Your Employees to Think. 658.386
C. R. Dooley. *The Nation's Business*, November 1924, v. 12, pp. 25-27. Urges training of employees by special courses designed to prepare them for more advanced positions.

A Training Program for the Factory Foreman. 658.31243
J. K. Novins. *Open Shop Review*, October 1924, v. 21, pp. 390-395. Article 11: Choosing text material for the foremen conference.

Transportation

Hints for Cargo Insurance Buyers. 656.6:368
Thomas Buel. *American Industrics*, October 1924, v. 25, pp. 43-45. Types of insurances and advantages of some over others.

Preparation of Freight Claims. 656.24
H. R. Park. *Central Manufacturing District Magazine*, November 1924, v. 8, pp. 79-81. Emphasizes the importance of including the necessary supporting documents and facts in presenting a claim.

The Railroads as Factors in Business. 656.2
C. H. Markham. *Railway Age*, October 4, 1924, v. 77, pp. 601-604. Discusses the part the U. S. railroads have played in the development of the industries of the country and considers also the subject of government ownership.

Shunting of Railroad Cars. 656.21
(Verschiebeanlagen für Eisenbahnwagen). R. Häuchen. *Maschinenbau*, September 11, 1924, v. 3, pp. 852-857. Illus. Shunting and shunting devices.

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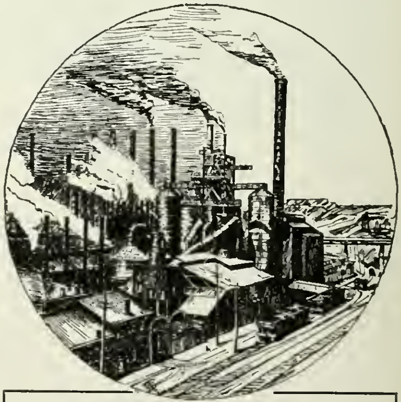

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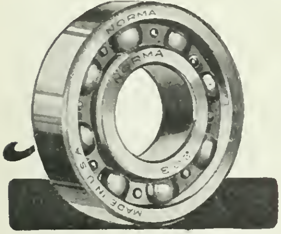

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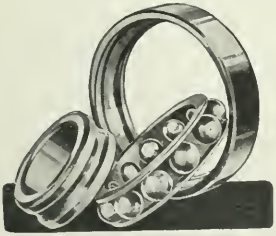

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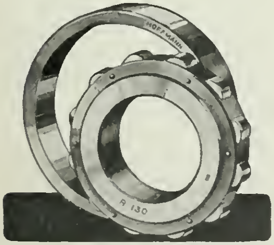

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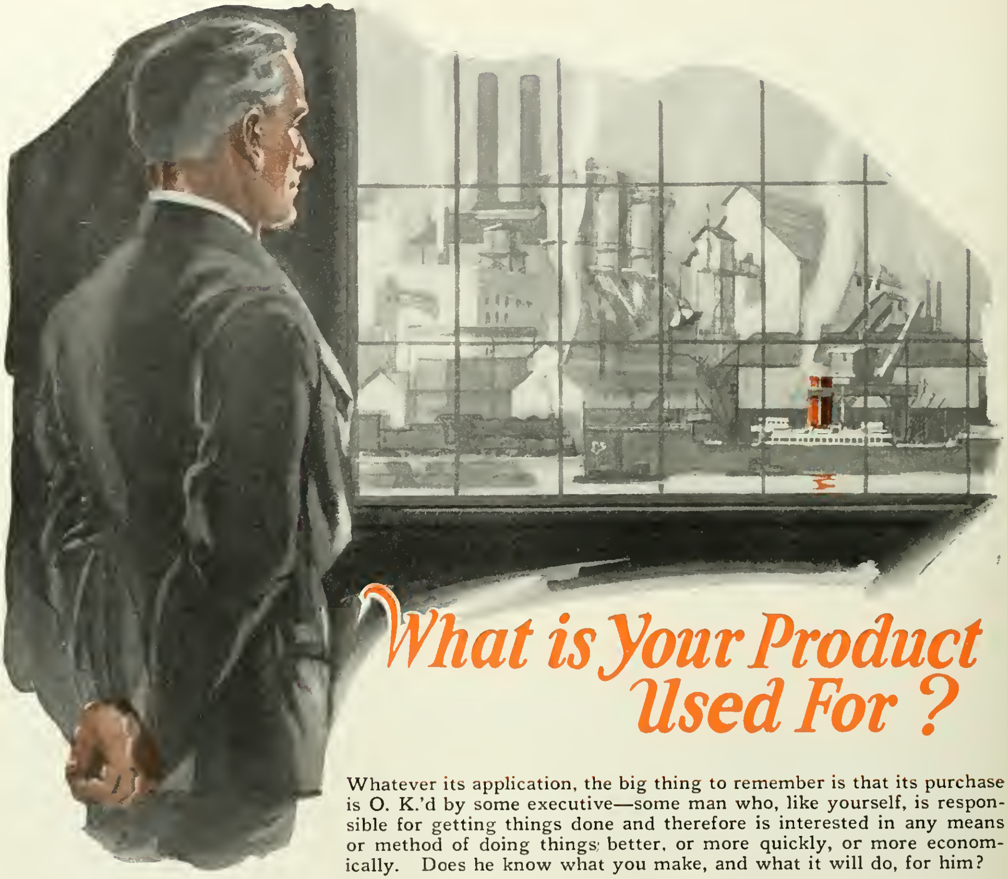

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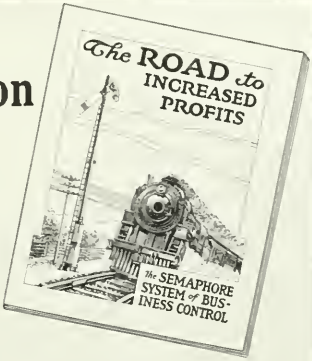
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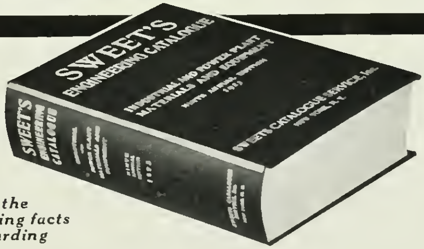
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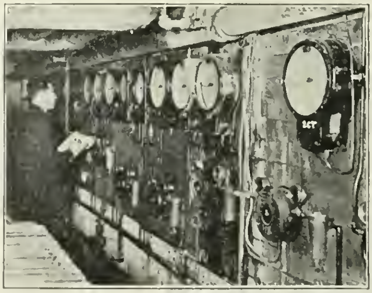

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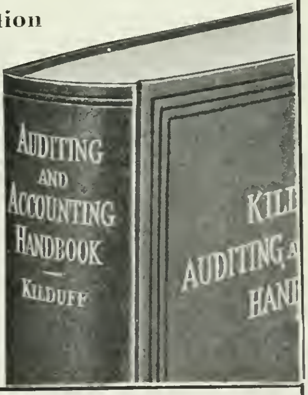

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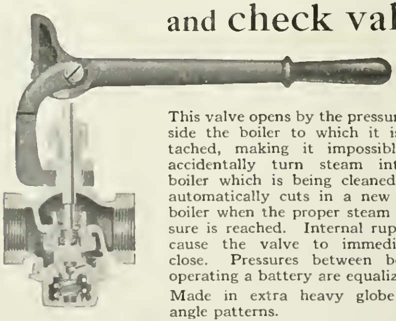

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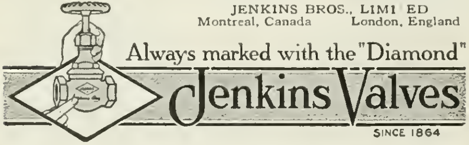
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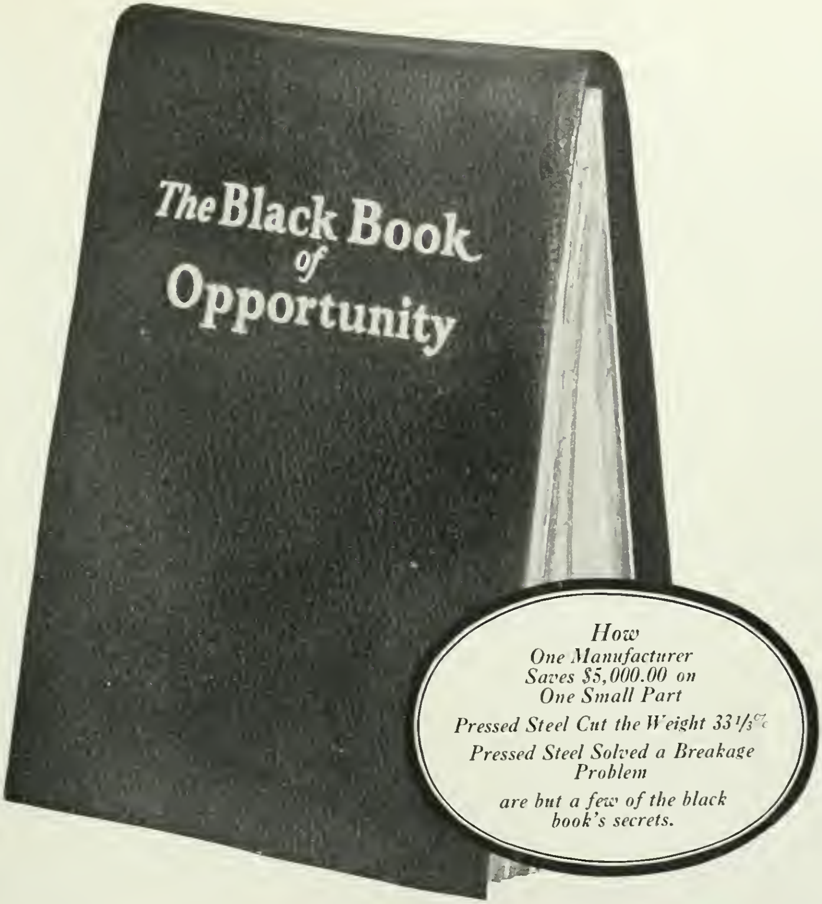

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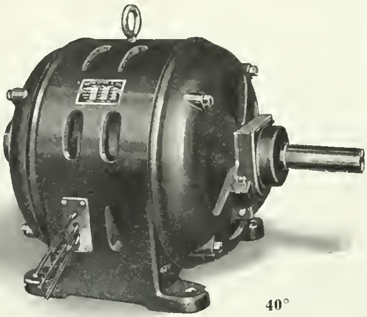

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- Norma-Hoffmann Bearings Corp.

Gas and Gasoline Engines
- General Electric Co.

Gearing
- General Electric Co.

Generating Sets
- General Electric Co.
- Irving Iron Works

Grating, Area, Sidewalk, etc.
- Irving Iron Works

Gratings, Steel
- Irving Iron Works

Grinding Machines
- General Electric Co.

H

Hammers, Steam
- Industrial Works

Heating Apparatus, Electric
- General Electric Co.

Hoists, Manual, Electric
- General Electric Co.

I

Instruments, Recording
- General Electric Co.
- Taylor Instruments Co.

Insulation, Electric
- General Electric Co.
- Powers Accounting Machine Co.

International Ticketograph
- Tabulating Machine Co., The

Inventory Control Service
- Tabulating Machine Co., The

L

Loose-Leaf Systems
- Moore, J. C., Corp.

M

Management
- Hopf, H. A., & Co.
- Richards, W. R., & Co.

Motors, Electric
- General Electric Co.
- Roth Bros. Co.
- Westinghouse Electric & Mfg. Co.

O

Office Equipment
- Acme Card System Co.
- General Fireproofing Co.
- Kardex Co., The
- Moore, J. C., Corp.
- Postindex Co., Inc.
- Precision Adding Machine Co.
- Remington Typewriter Co.
- Visible Records Equipment Co.

P

Piece Work Pay Systems
- Tabulating Machine Co., The

Pile Drivers
- Industrial Works

Pipe Coils
- The Superheater Co.

Power Transmission Machinery
- General Electric Co.
- Hyatt Roller Bearing Co.

Pressed Steel Parts
- Youngstown Pressed Steel Co.

Production Control Service
- Tabulating Machine Co., The

Production Management Engineers
- Cooley & Marvin Co.
- Scovell, Wellington & Co.

Publishers
- McGraw-Hill Book Co.
- Ronald Press Co., The

R

Rail Saws, Portable
- Industrial Works

Recording Instruments
- Calculagraph Co.

Rheostats, Motor
- General Electric Co.

Roller Bearings, Tapered, Plain and Babbitt
- Hyatt Roller Bearing Co.
- Stewart Mfg. Corporation.

S

Safes, Underwriters
- General Fireproofing Co.

Sanitary Drinking Cups
- The Vortex Company

Scales
- Merrick Scale Manufacturing Co.
- National Scale Corporation

Scrapers, Cable Drag
- Industrial Works

Shafting Bearings
- Hyatt Roller Bearing Co.

Shelving, Steel
- General Fireproofing Co.

Shipping Containers, Corrugated
- Hinde & Dausch Paper Co.

Stair Steps, Safety
- Irving Iron Works

Stampings
- Youngstown Pressed Steel Co.

Stokers
- Westinghouse Electric & Mfg. Company

Superheaters, Locomotive
- The Superheater Co.

Superheaters, Marine
- The Superheater Co.
- Youngstown Pressed Steel Co.

Superheaters, Steam
- The Superheater Co.

Systems, Business
- Cooley & Marvin Co.
- Ernst & Ernst

T

Tables, Steel
- General Fireproofing Co.

Tax Service
- Cooley & Marvin Co.
- Ernst & Ernst
- Hedrick-Garrett-Adelquist

Time Recorder
- Calculagraph Co.

Time Stamps
- Calculagraph Co.

Transformers
- General Electric Co.

Traps, Steam
- Sarco Co., The

Truck Platforms
- Youngstown Pressed Steel Co.

Trucks, Elevating
- National Scale Corporation

Typewriters
- Remington Typewriter Co.

Turbines, Steam
- General Electric Co.
- Westinghouse Electric & Mfg. Co.

V

Valves
- Jenkins Bros.

Valve Fittings
- Jenkins Bros.

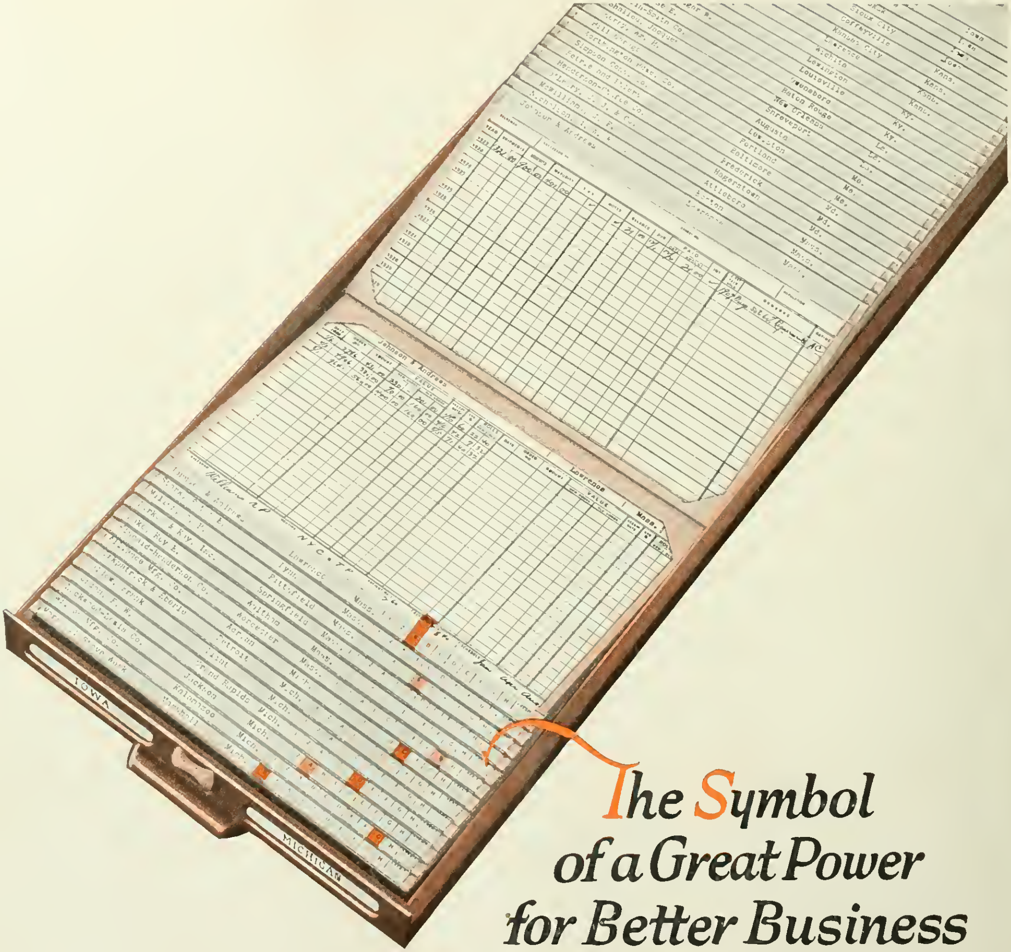
Valve Discs
- Jenkins Bros.

Visible Control Records
- Acme Card System Co.
- Kardex Co., The

Voltmeters
- General Electric Co.

W

Welders, Electric Arc
- General Electric Co.



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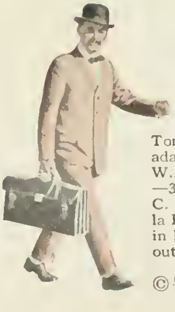

Send for The Kardex Man

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